Heating Piping & Air Conditioning

JUNE 1956

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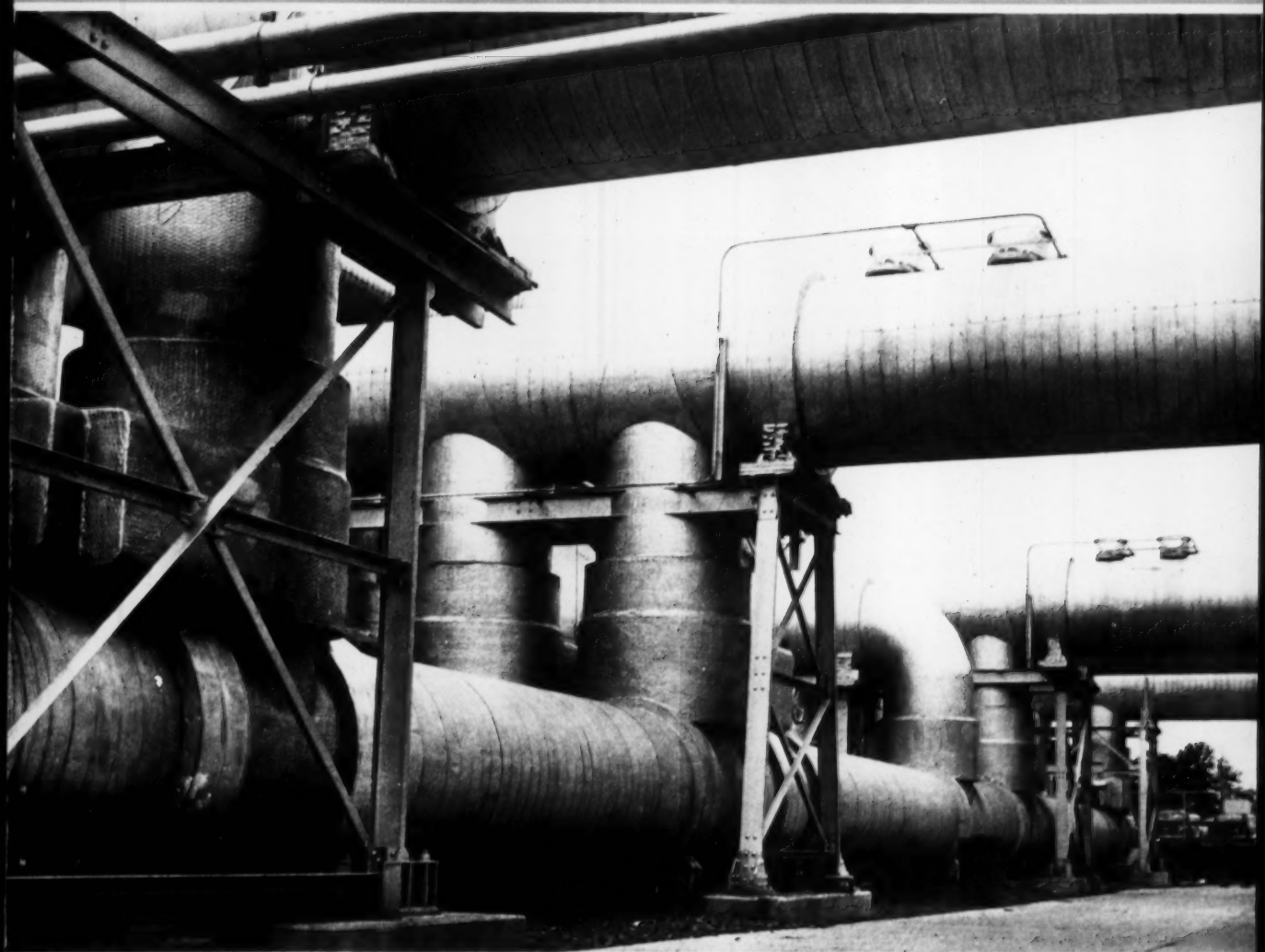
INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 113



Huge air piping systems serving the Navy's new jet engine test lab move 1 million cfm of conditioned air to simulate a wide range of flight conditions . . . . . page 73

NOW... greater piping loads, longer travels, with less headroom

The Grinnell Model R Constant-Support Pipe Hanger is available now in an *extended range* of sizes to provide completely overlapping coverage of loads from 47 lbs. to 32,267 lbs., and with travels up to 12 inches. New design modifications permit these hangers to be installed with a minimum of headroom, ranging from 29 inches (rod take-out) for the largest size — down to 10¾ inches for the smallest size.

The Model R provides constant support which is mathematically perfect for all positions of travel. This constancy of support is maintained throughout the full range of field adjustability. Needle bearings minimize friction.

Grinnell Constant-Supports are individually calibrated to support the exact load specified. All Model R Constant-Supports have a full 70 percentage points of field adjustability built into them. No less than 10% of this adjustability is allowed either side of calibration for plus or minus change in load. Field re-adjustments are easily made by turning a single load adjustment bolt.

Grinnell designs, manufactures, and distributes a complete line of pipe hangers and supports for every piping requirement. Grinnell maintains an experienced staff of engineers in the field — ready to assist you on the job with any piping problem.

GRINNELL

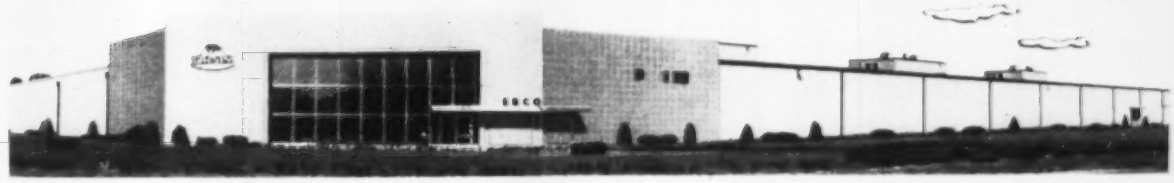
AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

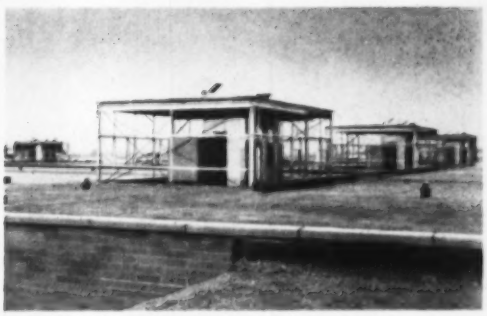
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves • Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies • industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

usAIRco

self-contained RK units cool new $3,000,000 windowless "dream" plant





Each penthouse contains an individually operating 100-ton (two 50 h.p. RK) system serving a separate area of the building. Units containing built-in water-saving evaporative condensers are factory-assembled and tested. Each unit was elevated to the roof in one piece. Photo taken during installation.

Supply ducts deliver conditioned air over a radius of 75 feet. Twenty-two feet high ceilings permit high velocity without creation of drafts at the working level.

240,000 sq. ft. Ebco Manufacturing Company conditioned by twelve 50 h.p. Central Station Units, located in six roof penthouses

A new application of comfort conditioning is found in the Columbus, Ohio home of Ebco, world's largest producer of office type water coolers. The all-year system includes 12 usAIRco RK-50's, six gas fired heaters which use the RK blowers for circulation. Both cooling and heating are available at all times because change-over is automatic.

This system was selected after a study revealed central chilled-water and built-up installations were too costly. The advantages of the self-contained station were many. (1) Zone control is automatically provided. (2) Breakdown of equipment would not affect entire plant. (3) Expansion of plant would only require the addition of units . . . no revision of present installation. (4) No licensed fireman or engineer is required. (5) Automatic refrigerant pump-down is built into RK units. (6) Night watchman can make any adjustments required during non-working hours. (7) All controls in one central panel.

Forty-eight additional tons are used to condition the offices, lobby, and conference rooms.

E & Y Building Service, Inc., were the contractors and provided the design through architect Merle Robert Maffit, A.I.A.

for descriptive literature on RK's write: C. A. Hawkinson

UNITED STATES AIR CONDITIONING CORPORATION

MINNEAPOLIS 14, MINNESOTA • *Export: 11 E. 40th St., N. Y. 16, N. Y., U.S.A.*

usAIRco
50 YEARS OF AIR CONDITIONING

An engineering fact...

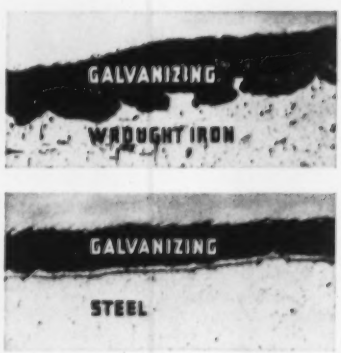
WROUGHT IRON PIPE takes up to a 50% heavier coating of ZINC

Tests prove the iron silicate fibers which give wrought iron its unusually high resistance to corrosion are also responsible for the material's ability to accept a considerably thicker hot-dip zinc protective coating than steel.

Our bulletin, *Piping for Permanence*, discusses galvanic protection, and reviews a variety of wrought iron pipe services. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world



These photomicrographs illustrate the ability of wrought iron to receive a tighter, heavier zinc coating. Because the life of the coating is directly influenced by its adherence and weight or thickness, zinc coating on wrought iron lasts longer.

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 28 No. 6

JUNE 1956

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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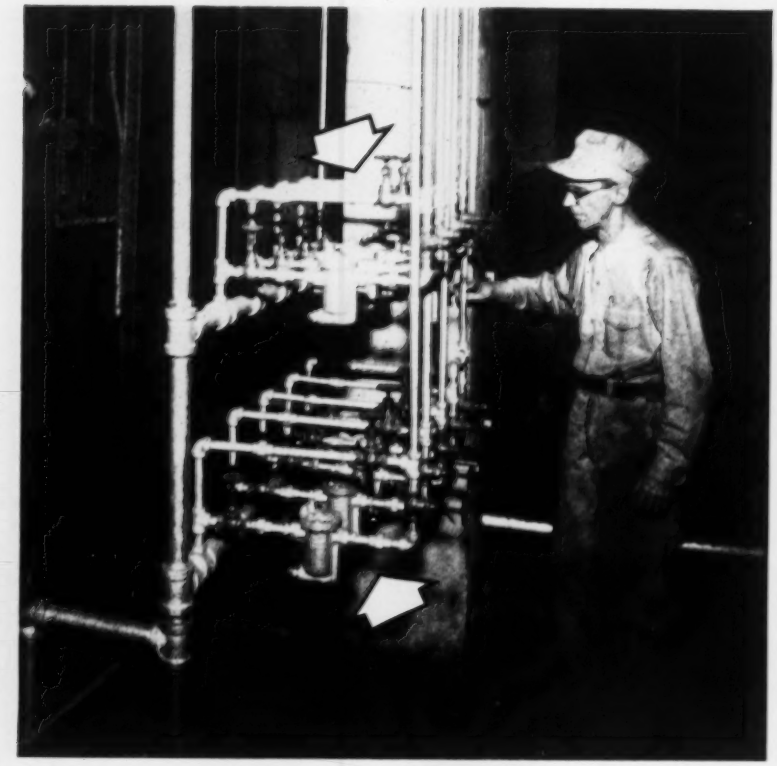
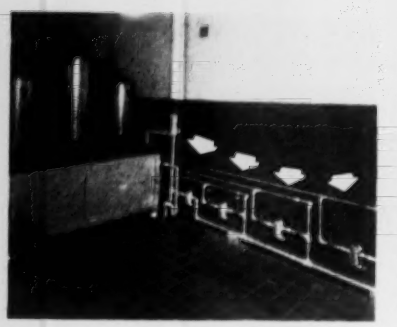
Good Trapping Practice with Good Traps Roy Davis, Maintenance Superintendent, looks over one of the well-engineered Armstrong trap installations he has made at the Masonic Temple in Detroit. Traps discharge to 15" vacuum.



Keeping the Coffee Perkin' with Armstrong traps draining steam heated coffee urns.



Detroit's Masonic Temple Solves Vacuum Loss by Installing Armstrong Inverted Bucket Steam Traps

■ MANY AN engineering hour has been spent ferreting out the leaks in a vacuum return system. Here's a tip if you have the problem: *check your steam traps.* Don't worry about *flash* steam from traps—look for the traps that are leaking *live* steam. Take the case of the big Masonic Temple in Detroit:

The 11,600,000 cubic foot building has banquet space for 4500 persons at a sitting. Imagine the bedlam in the kitchen when the steam heated cooking equipment couldn't meet dinner schedules!—simply because condensate drainage was sluggish. The cooks were always in a stew and calls to the maintenance department were daily occurences.

The building buys 35 lb steam from Detroit Edison. Line pressure is used for the cooking kettles, while regulating stations supply 2 to 3 lb steam for the heating system.

Couldn't Hold Vacuum

Prior to the installation of Armstrong traps, maximum vacuum attainable was 4 inches and in some cases it was necessary to manually drain the systems and dump the condensate.

According to Roy Davis, Maintenance Superintendent, the installation throughout of Armstrong inverted bucket steam traps has solved the problem. *"I don't remember having had the chefs complain since . . . the kettles heat in a hurry now."*

F. W. Emblin, Operations Manager, adds, *"You can check the vacuum gage any time now and seldom find less than 15" showing."*

There's another nice part to this story that only time will reveal: Armstrong traps have a habit of delivering this kind of service on low pressure vacuum return systems for years and years without repairs. Your local Armstrong Representative has plenty of cases he can tell you about. Why not call him today?

ARMSTRONG MACHINE WORKS
874 Maple Street • Three Rivers, Michigan

FACT-FULL LITERATURE FOR YOU

FREE: 44-Page Steam Trap Book plus two reprints explaining facts about trap operation on vacuum return service.

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan
Please send Steam Trap Book, "Flash at Traps" and "Vacuum Isn't Vacuum."

Name _____
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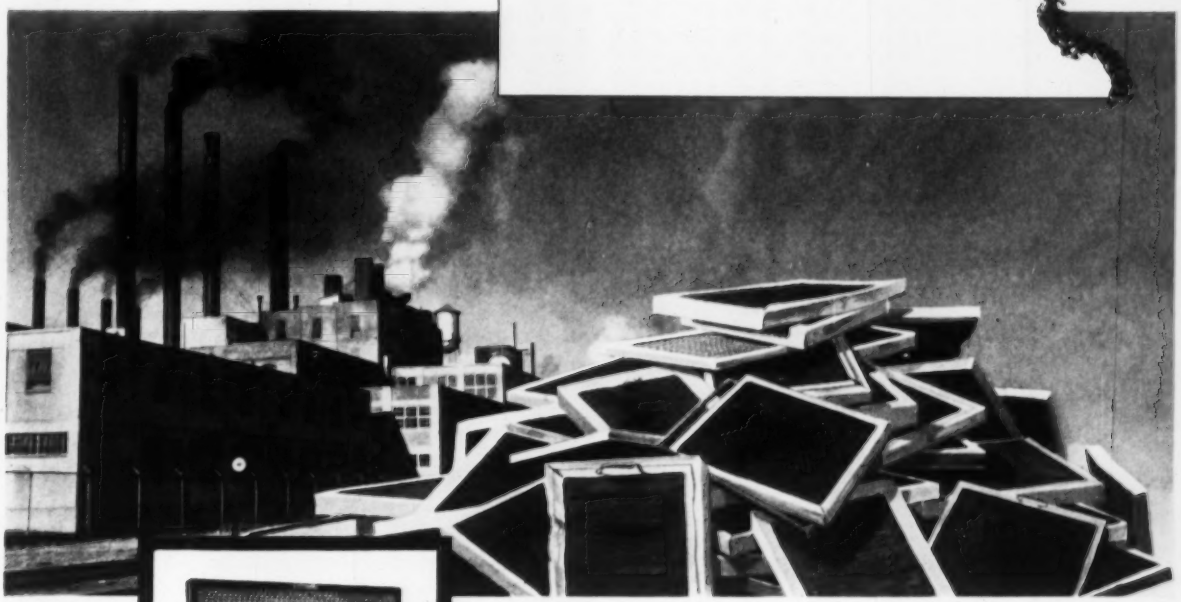
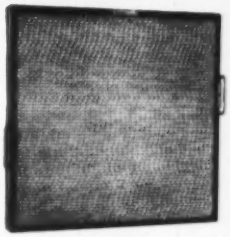
HERE'S THE SEQUEL TO "...or equal"





Standard 2" FAR-AIR Panel Filter.

Send for your copy showing complete specifications on the FAR-AIR line of quality filters.

When you see this specification..."FAR-AIR® filters or equal" remember that these filters *have no equal*. Substitutes mean contributions to the junk pile and higher eventual costs, so it pays to install the finest—FAR-AIR.

In FAR-AIR you get filters that handle more air with greater efficiency. Because of their greater dirt-holding capacity, you save up to 60% in maintenance. The "lifetime engineering" of FAR-AIR filters with their heavier frames, reinforcing rods and other features, insures that each unit will continue to operate with replacements virtually eliminated.

Yes, you'll want to use FAR-AIR filters eventually, so why not install them initially. Write for complete catalog information to FARR COMPANY, P.O. Box 45187, Airport Station, Los Angeles 45, California.

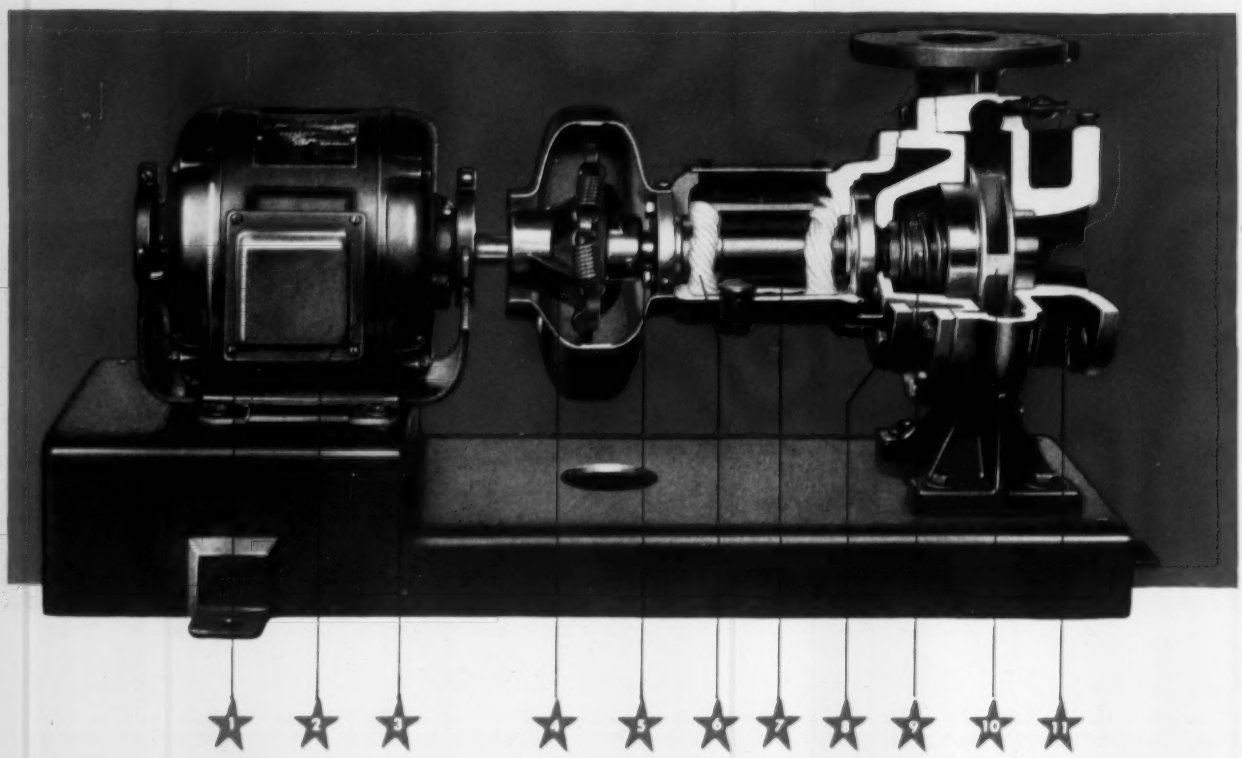
ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE

FARR COMPANY

NO COMPROMISE ON QUALITY

Los Angeles, New York, Chicago, New Orleans

WHY B & G UNIVERSAL PUMPS



DESIGNED SPECIFICALLY FOR *QUIET* OPERATION IN LIQUID HEATING AND COOLING SYSTEMS

The circulating pump in a hot water heating or chilled water cooling system is the connecting link between the mechanical equipment in the boiler room and the structure itself. *Silent, vibrationless* operation is therefore the prime requirement in a pump for this type of service. The features starred above are the reasons why the B&G Universal Pump fully meets this need.

THE MOTOR

1. **Extra quiet.** The Universal Pump motor is specially constructed, tested and hand-picked for extra-quiet operation.

2. **Sleeve bearings.** Motors are equipped with oil lubricated bronze sleeve bearings—essential to silent operation and long life.

3. **Mounting.** Universal motors, through 5 HP, are NEMA ring-type mounted and completely suspended in noise-dampening rubber. All motors are drip-proof.

THE PUMP

4. **Coupler.** Self-aligning, spring-type...another warranty of silent operation, plus excellent pump and motor protection against the stresses of starting torque.

5. **Shaft.** Big—oversized—affording large bearing surfaces. Made of special alloy steel, polished to mirror finish. Heat-treated integral thrust collar absorbs end-thrust... lengthens seal and motor bearing life.

6. **Lubrication.** Genuine oil circulating. No grease to channel or harden. Oil level indicator permits visual check.

7. **Sleeve bearings.** An essential for quiet, vibrationless operation and long life of both pump and motor. An outstanding Universal feature.

8. **Removable bearing frame for easy servicing.** The entire bearing frame assembly with impeller is easily removed from volute. No pipe connections to break or motor to remove...all the advantages of split case design. All bearing frame assemblies are interchangeable.

9. **Mechanical seal.** Positively prevents water leakage up to full design pressures. The seal is self-lubricating and features a floating seat of diamond-hard "Remite"—a B&G development.

10. **Hydraulically balanced impeller.** Balancing chamber and thrust pressure relief holes in the impeller reduce thrust to a minimum.

11. **Solid volute.** Support feet directly below volute absorb piping strains without distorting pump alignment.

MEET THE TOUGHEST TEST... *QUIET OPERATION!*

The National Home Office of the Allstate Insurance Company, equipped with B&G Universal Pumps.

Architects and Engineers Dudley & Beyer, Chicago
Heating Contractor: Economy Plumbing and Heating Co., Chicago

Three B&G Universal Pumps circulate hot water to a split plenum coil system in central fan rooms on the first, second and third floors of the building. The system is also equipped with B&G Flo-Control Valves and Relief Valves.

BELL & GOSSETT
COMPANY
Dept. EJ-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, W. Toronto

The challenge of integrity

A reputation for integrity—daily challenged and daily put to test—is established only through years of proven performance. Pennsalt's 106-year history of supplying top-quality products and service to industries depending upon close control of quality has met the challenge and established the reputation.

On the opposite page are details about Pennsalt's new ISOTRONS—the latest word in fluorinated refrigerants. The air-conditioning and refrigeration industries can depend on the integrity of Pennsalt to stand behind the ISOTRONS for quality, uniformity, performance, and value.

PETROLEUM REFINING calls for the utmost precision in raw materials supply and processing. Pennsalt chemicals meet industry's rigid standards of purity & uniformity.

HIGH-ALTITUDE FLIGHT relies on Pennsalt fluorine and chlorine trifluoride to provide the exact oxidizing power for blazing rocket fuels.

HUMAN LIVES AND HEALTH depend on the purity of drinking water. Municipal water systems throughout the country use Pennsalt chlorine for purification.

ISOTRON

THE LATEST WORD IN REFRIGERANTS

Pennsalt—a pioneer in modern fluorine chemistry—proudly announces the ISOTRON* line of refrigerants, soon available in commercial quantities from a new Pennsalt plant now being built at Calvert City, Kentucky. Of highest quality, competitively priced, and COMPLETELY INTERCHANGEABLE with other fluorinated refrigerants, ISOTRON products are geared to the rapidly increasing demands of this industry.

The new ISOTRON line will include ISOTRON 11, ISOTRON 12, ISOTRON 22, and ISOTRON 113—backbones of the fluorinated refrigerant field. They're of precisely the same formulas as other products of this kind, and they'll be manufactured with the rigid quality control you expect of Pennsalt. Optimum quality and uniformity are assured.

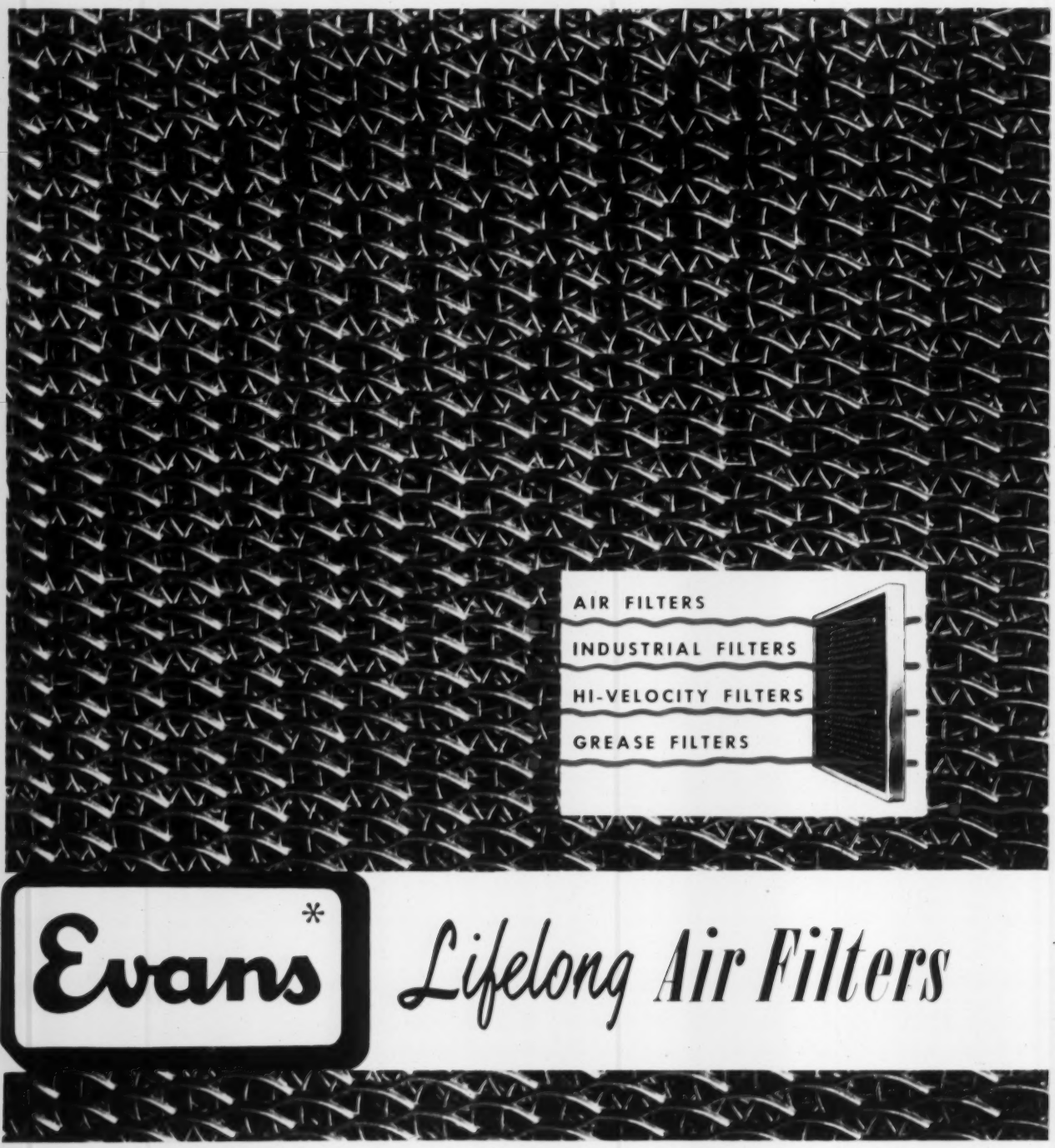
IF YOU USE FLUORINATED REFRIGERANTS investigate the advantages of ISOTRONS. Benefit from Pennsalt's pioneering research and progressive thinking in refrigerant manufacturing! Pennsalt offers you well-staffed sales-service laboratories, and specialists who are eager to work with you. Learn all the facts about ISOTRON refrigerants—write Technical Services Dept. 330, Industrial Chemicals Division, Pennsylvania Salt Manufacturing Company, Three Penn Center Plaza, Philadelphia 2, Pa.

*ISOTRON IS A TRADEMARK OF THE PENNSYLVANIA SALT MFG. COMPANY

Pennsalt Chemicals

THESE BIG CAPACITY FILTERS*

DEFINITELY LOWER



Evans*

Lifelong Air Filters

FOR HI-VELOCITY APPLICATIONS

AIR CLEANING EXPENSE

Precision stamped pack, precision assembled, with larger openings on inlet side . . . progressing to smaller openings on outlet side delivers *CONSISTENT DOUBLE-LINT-HOLDING-CAPACITY.*

• • •

Special open-flow, low resistance design, super cleans the air. Precision angled openings force air into extremely high turbulence. Cause it to travel 3.5 times filter depth from inlet to outlet side. Rough talon-like edges grip and hold dirt. Let the pack absorb great quantities of lint without choking off the air stream. Both laboratory and field tests have conclusively proven:

• • •

EVANS FILTERS COLLECT AND HOLD MORE DUST AND LINT FROM THEIR INITIAL RESISTANCE TO .050″ wg., .075″ wg., 1.00″ wg., OR WHATEVER RESISTANCE DEEMED NECESSARY TO CLEAN FILTERS.

• • •

LIFETIME DESIGN PROVIDES LOWER COST PER CUBIC FOOT OF AIR HANDLED

One filter purchase . . . one set of filters last the life of your clients' air handling equipment. Eliminates call back expense.

• • •

ALL ALUMINUM DESIGN PROVIDES LOWER COST PER CUBIC FOOT OF AIR HANDLED

Every part of frame and medium precision stamped from aluminum (*not a foil*). Corrosion resistant. Rust proof. Light weight. Easy to handle. No dangerous edges. No sharp wires to tear or cut workers' clothes or hands.

MAINTAIN OFFICIALLY RATED DUST HOLDING CAPACITY IN THE FIELD

Evans filters are tested with a realistic dust (contains 18% lint). THE KIND OF DUST ACTUALLY FOUND UNDER TRUE OPERATING CONDITIONS. This has resulted in Evans exclusive *big capacity* design.

Remember, the initial cost for heating and cooling equipment is not the big controlling factor in the cost for clean air. *It is the operating cost that you must live with . . . that you must control.*

EVANS FILTERS SAVE 50% ON CLEAN AIR MAINTENANCE COSTS. They use no messy, dirty, high tension adhesive oil. Evans require but a few ounces of fluid. This fluid is double acting . . . both an adhesive and a detergent. Actually helps wash the filter when water is hosed on. Evans filters clean quickly. Require no dangerous caustics. No special room.

Whether you are specifying filters for air handling equipment in the design or operational stage, it will pay you to get facts on Evans filters. Write today for complete free information.

MAIL THIS COUPON TODAY!

THE GEORGE EVANS CORPORATION • MOLINE, ILLINOIS

Gentlemen: I want to learn more about BIG CAPACITY EVANS AIR FILTERS and how they will *definitely lower my air cleaning expenses.*

Name _____

Company _____

Address _____

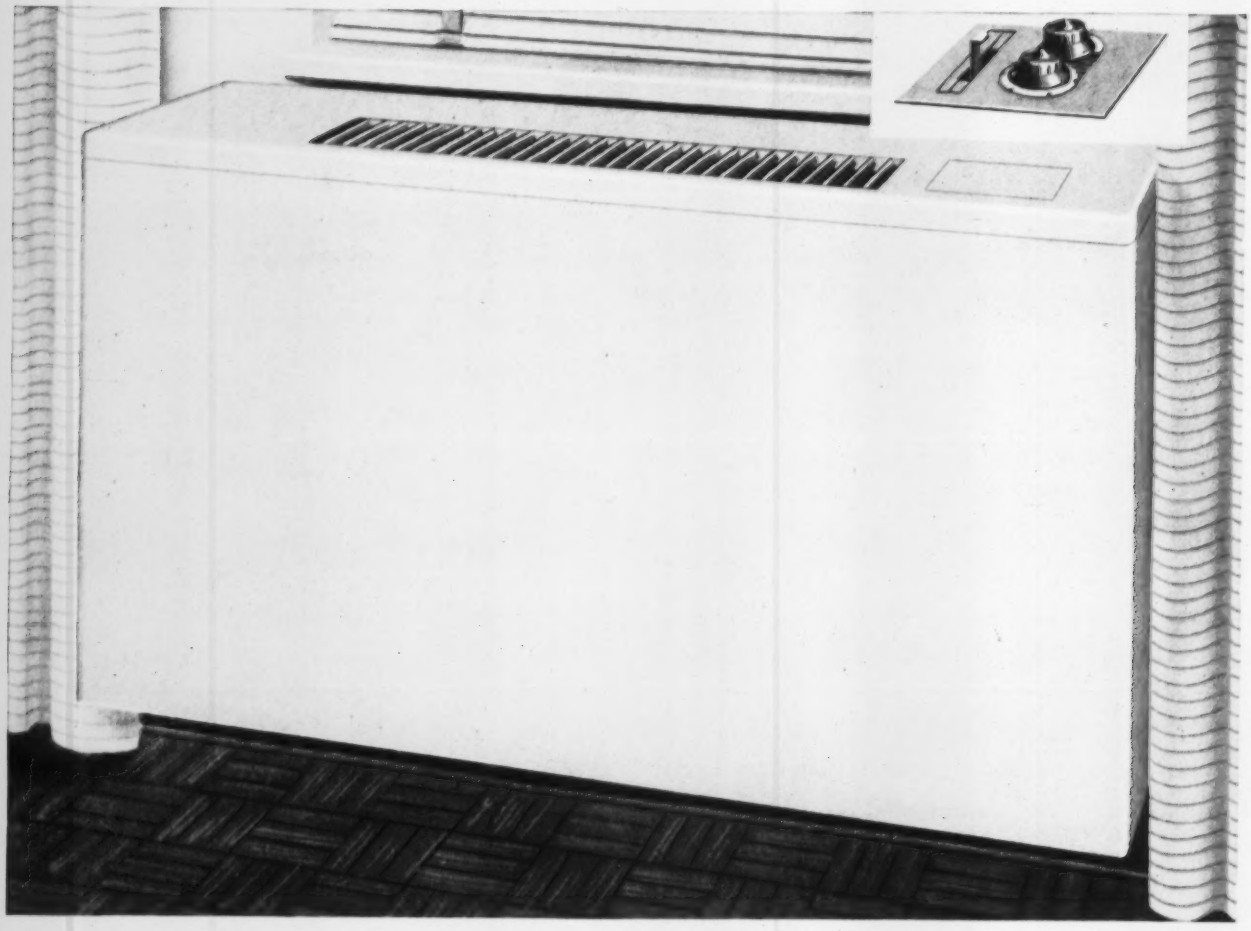
City _____ State _____

FREE

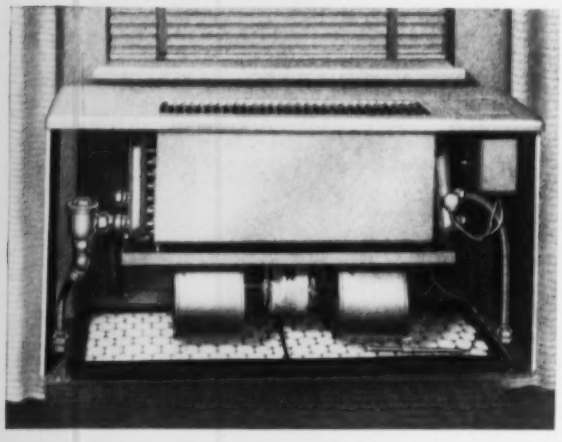
COMPLETE ENGINEERING DATA

- DUST LOAD CURVES
- EFFICIENCY RATINGS
- PRESSURE LOSS CURVES

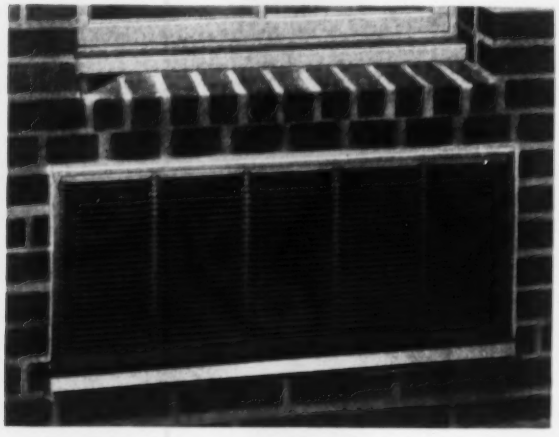
NOW . . . A flexible year-round air conditioning



This wall-mounted model is installed 3" off the floor—leaves wall-to-wall carpeting and wiring intact. The compact cabinet measures only 21½" high and projects only 10⅝" into the room when installed in 12" wall. Each unit is individually controlled . . . with all controls mounted on a single control panel. Unit also available with front outlet grille.



Model SR Remotaire consists of two basic parts—the cabinet and sleeve assembly and the chassis assembly. After the cabinet and sleeves are installed, the chassis is simply slid into place. Both the compressor and condenser are located *in the wall* behind a bulkhead—this exclusive design feature minimizes any operating and vibration noise . . . makes a neater installation.



The outside grille is flush-fitting, with no unsightly overhang. In addition, the unique design of the grille, flashing pan and bulkhead provides protection against outside weather interfering with the operation of the unit.

system *without* a central cooling plant

A NEW REMOTAIRE

by AMERICAN-Standard

- *Compact, self-contained refrigeration unit*
- *Simple connection to steam or hot water heating system*
- *Suitable for existing or new buildings*

Now, with the new American-Standard Self-Contained Remotaire, no building need be without the comfort of efficient year-round air conditioning. That's because the Model SR Remotaire is designed with an independent, self-contained refrigeration circuit with air-cooled condenser (no water required), plus provision for simple connection to the steam or hot water system.

Installation of this new ¾ or 1 hp unit is quick and easy. For modernization work, merely cut a small opening through the wall and insert the unit. No central cooling plant is required, yet room occupants enjoy all the advantages of year-round-comfort conditioning with individual room temperature control.

New Self-Contained Remotaires may be installed one room at a time or one floor at a time—anytime—without disturbing normal operations. Individual installation takes only a day or two—a very important advantage for hotels, motels, apartments and office buildings.

You'll save lots of installation time and labor with this practical, space-saving unit. Builders and owners also are assured of dependable operation with minimum upkeep. For detailed information on this new version of the famous Remotaire, simply return the coupon below: AMERICAN-STANDARD PLUMBING AND HEATING DIVISION, 40 West 40th Street, New York 18, New York.

AMERICAN-Standard

American-Standard Products

American-Standard Plumbing and Heating Division, Dept. HP-66
39 West 39th Street, New York 18, New York

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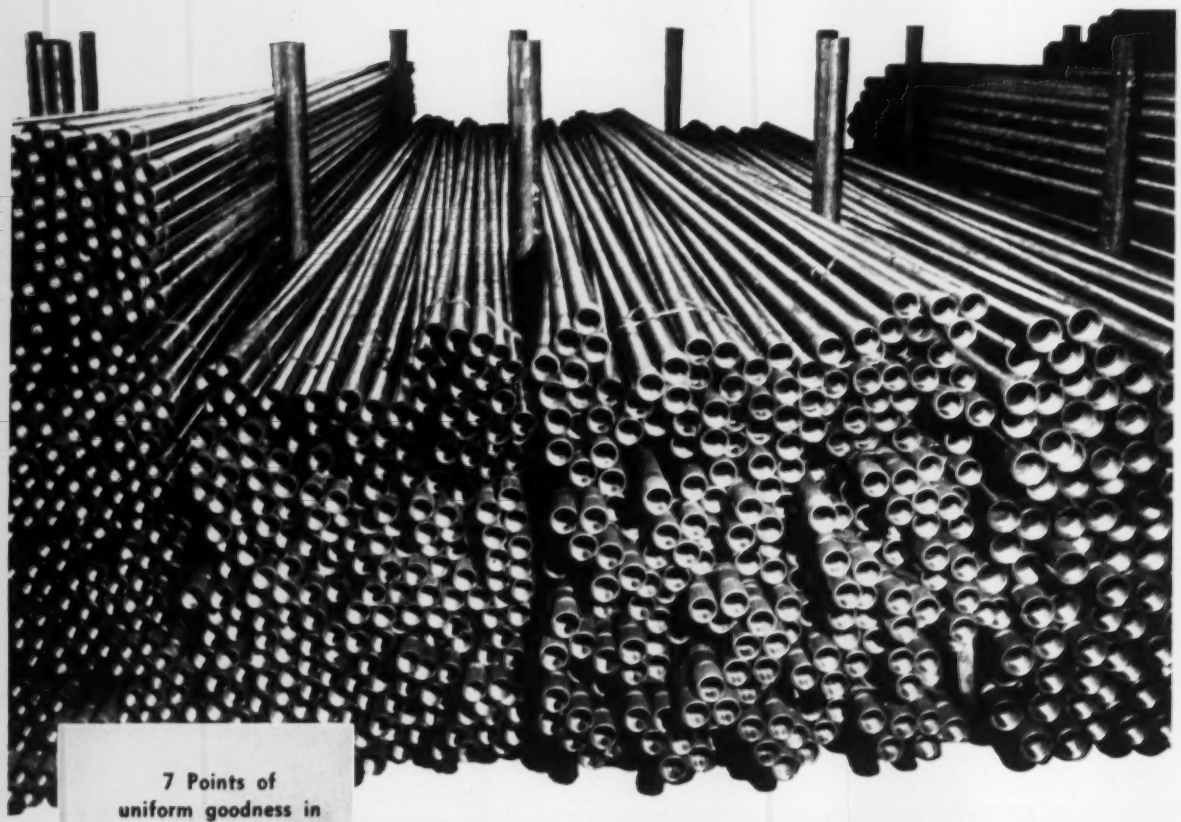
Address .....

City ..... Zone ..... State .....

UNIFORM LENGTHS OF YOUNGSTOWN PIPE

make your job easier, quicker

. . . yet more efficient



7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

You may compare the importance of uniform lengths of Youngstown Pipe with having the right tool for a job . . . the right nut for a bolt . . . the right washer for a fitting. There's no lost motion. The length you specify is the length you get.
Combine this with the 6 other points of uniform goodness in Youngstown Pipe and add the fact that Youngstown is made only of the finest steel, quality controlled from ore to finished product, and you have a real prize winner! Be sure to specify Youngstown on your next order.

Youngstown PIPE

QUALITY YOUNGSTOWN SERVICE

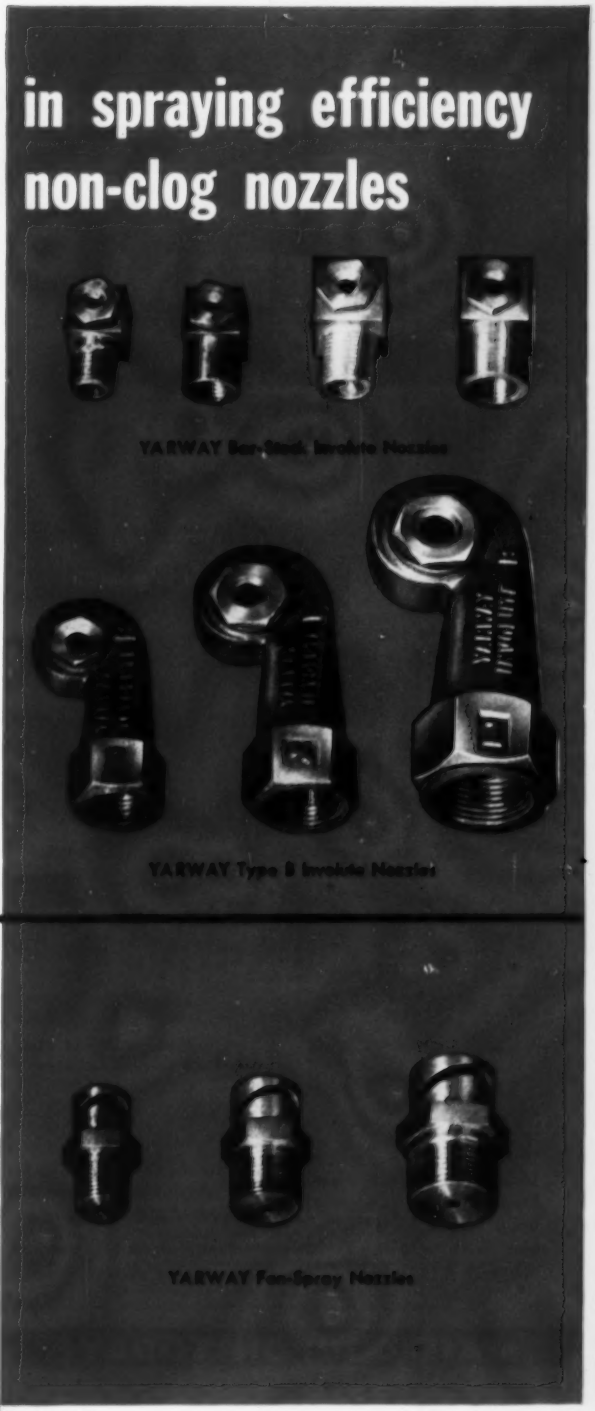
THE YOUNGSTOWN SHEET AND TUBE COMPANY Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

reach a new peak with YARWAY

in spraying efficiency non-clog nozzles



cone spray

Most popular design for cooling, recooling, washing, rinsing, air conditioning, drying and other spraying operations in industrial and processing work and in power plants.

Non-clog involute design has no internal parts (vanes or deflecting plates) on which foreign particles can collect. Special contour of nozzle body guides flow with minimum loss of energy towards discharge opening, where liquid attains maximum velocity and leaves nozzle in a fine hollow-cone spray.

Available in three types:

Bar-stock bronze (shown) for fine spray
Sizes ¼" and ⅜", male or female connection
Capacities up to 3 gpm; pressures 20 to 50 psi

Cast bronze Type B (shown) for air conditioning and small recooling systems
Five sizes, ½" to 1½"
Capacities up to 40 gpm; pressures 7 to 25 psi

Cast bronze Type C (not shown) for spray pond service
Sizes 2" and 2½"
Capacities up to 110 gpm; pressures 7 to 15 psi

Write for YARWAY Spray Nozzle Book N-617; it gives capacities, dimensions and application information.

fan spray

Preferred for many washing and cooling operations. Non-clog design, delivers flat fan-shaped sheet of spray with slicing action particularly desirable for surface washing.

Thin sheet of spray is discharged forward 30° from the vertical, spreading in fan shape up to 140°, depending on operating pressure.

Made of bronze, steel or other bar-stock metals, male thread, six sizes ⅛" to 1", capacities up to 7 gpm, pressures up to 50 psi.

Write for YARWAY Spray Nozzle Book N-617.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY spray nozzles

FOR EVERY NEW CEMENT PLANT

B. R. DeWITT, INC.

Prominent N. Y. State Road Builders

ORDERED A NEW

AMESTEAM GENERATOR

20 sizes,
10 to 600 h.p.
15 to 200# Oil, Gas
or Oil-Gas Combination.

"In our business," reports Mr. B. R. DeWitt, "we can't afford delays. When we need hot water for a mix or steam for thawing in cold weather — we need plenty of it, on time! AMESTEAM GENERATOR has always delivered for us. Just push a button — you've got steam in a few minutes. Maintenance is almost nil, and our AMES representative is ready with service 24 hours a day. Sure, we ordered AMESTEAM GENERATOR for every new DeWitt cement plant. We know we can depend on their rugged dependable equipment."

"REPEAT" ORDERS

like those of B. R. DeWitt, Inc., Pavilion, N.Y. Road Builders, are continual proof of user satisfaction with AMESTEAM GENERATORS.

2 MORE ORDERED

Besides the seven units in DeWitt plants, Mr. DeWitt has ordered and just taken delivery on two additional units for new plants in the vicinity of Rochester, N.Y. The 9 AMESTEAM GENERATORS range in size from 40 to 80 h.p.

For satisfaction like this — for dependable steam production and economy over the years — you take no chances when you specify AMESTEAM GENERATOR!

MAIL COUPON TODAY!

AMES IRON WORKS, INC.
BOX D-66, OSWEGO, N.Y.

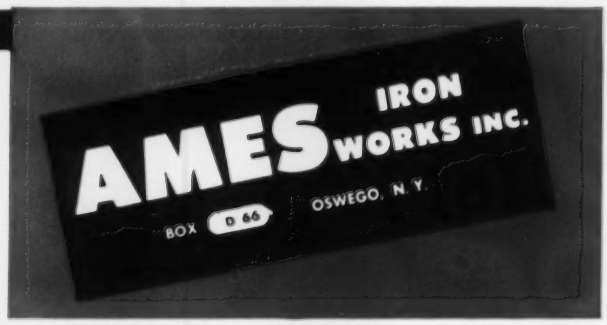
Gentlemen:

Please send me further information on AMESTEAM GENERATORS and name of the nearest representative.

NAME

COMPANY

ADDRESS



take a good look at the Walworth "500 Brinell" no. 225P Globe

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

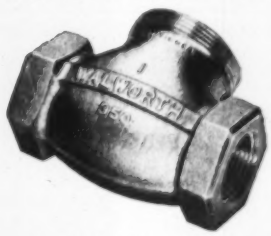
IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.



EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,200 psi.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

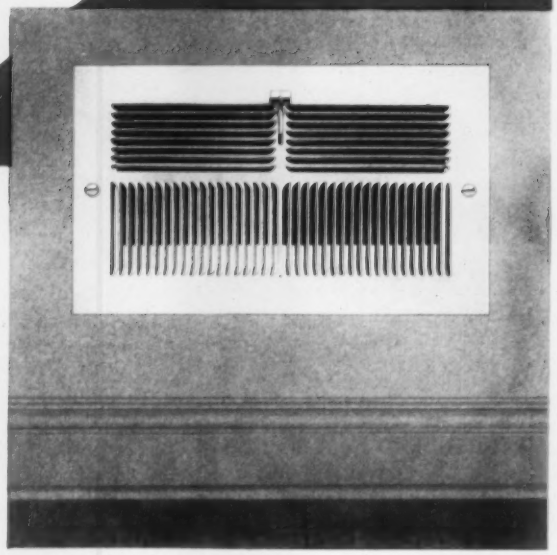
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

INDEPENDENT

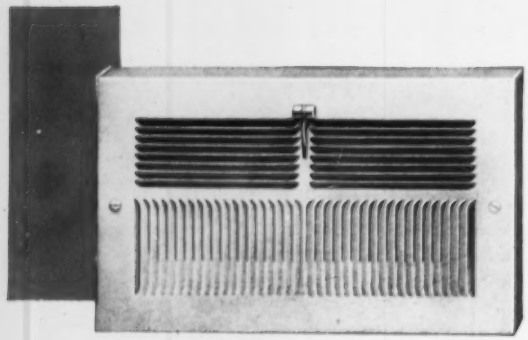
Perimeter Registers For Sidewall and Out-of-Wall Baseboard Installations

SIDEWALL MODEL

Style No. 149 sidewall diffuser register for flush mounting blankets the outside wall. The circulating air is evenly distributed in a fan-shaped pattern and moves out and up closely paralleling the wall surface. Furnished in 10 x 6, 12 x 6 and 14 x 6 sizes.



No. 149



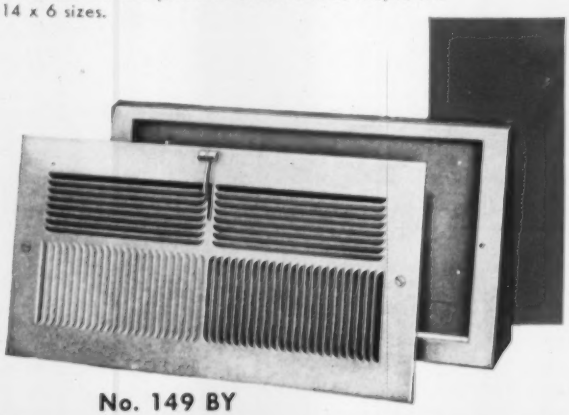
No. 149 BO

BASEBOARD MODELS

Style No. 149 BO—designed for baseboard installation—is flanged on top and both sides with a ⅞-inch flange. Fins are set at same angles as the No. 149 style and produce the same air-flow pattern. Furnished in 10 x 6, 12 x 6 and 14 x 6 sizes.

Style No. 149 BY—designed for out-of-the baseboard installation—consists of two parts—register face and mounting frame. A rubber gasket on the register face seals the face to the frame. The solid back frame fastens to the wall. A stack head is unnecessary since the bottom of the frame is cut for boot or fitting. Furnished in 10 x 6, 12 x 6 and 14 x 6 sizes.

Write for Price List



No. 149 BY

ALWAYS LEADING — ALWAYS PROGRESSING

The Independent Register Co. 3747 E. 93rd St., Cleveland 5, Ohio

DOLLINGER

STAYNEW FILTERS FOR EVERY VENTILATING APPLICATION

STAYNEW AUTOMATIC AIR FILTERS

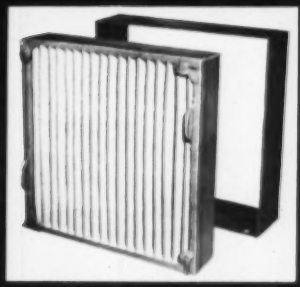
Designed for filtering large air volumes efficiently, these self-cleaning filters give you *positive protection* against oil entrainment in the air stream. This protection is provided by an *exclusive Staynew* feature—a second *dry* curtain providing a double filtering action. Ask for Bulletin 500.

VISCOUS PANEL FILTERS

Low cost, permanent, washable type for locations where highly efficient filtration is not required. Large dust-holding capacity with amazingly low resistance to air flow. Unsurpassed for ease of cleaning. Ask for Bulletin 700.

DRY PANEL FILTERS

Highly efficient for heavy duty Ventilation work. Operates with any filtering medium that comes in sheet form and can be crimped. Preformed media can be inserted quickly and easily when required. Ask for Bulletin 600.

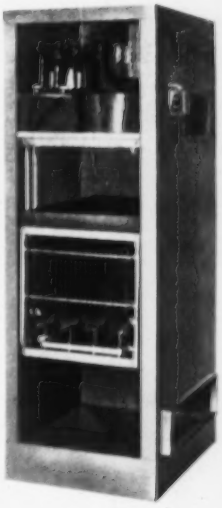


ELECTRO-STAYNEW PRECIPITATORS

Highly efficient—removes 90% of all air-borne dirt, including smoke, dust, pollen, oil mist. Ionizer and Collector in one unit. Available in single unit of 1200 and 1800 CFM; any capacity in multiple units. Ask for Bulletin 400.

ELECTRO-STAYNEW MIST COLLECTOR

Provides self-contained ventilating system for individual machine tools. Removes air contaminated with oil, smoke, grit, and chips and returns clean air to shop. Saves you hundreds of dollars in building maintenance expense and lost man-hours due to employee sickness. Ask for Bulletin 420.



AFI MEMBER

Whatever your filtering problem, wherever you are, there's a Dollinger representative ready to help you solve it with a *Staynew* filter—the *only* complete line of industrial and ventilating filters available.

Write today, and ask for catalogs describing the filters illustrated above. Dollinger Corporation, Dept. 9, Centre Park, Rochester 3, N. Y.

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

HELP WASH 375,000 CFM OF AIR *at Douglas Aircraft, Inc.*

Keeping the exhaust air from the paint spray hanger clean by use of air pollution corrective equipment to comply with Los Angeles Air Pollution Regulations at the giant Douglas Aircraft Plant at El Segundo, Calif. is a tremendous 24 hour a day job. It's being done very adequately by this efficient installation of *Erikson Manufacturing Co.*, of El Monte, Calif. To draw the large volumes of air thru their special washers these six large "Buffalo" Limit-Load® Centrifugal Fans with a total capacity of 375,000 cfm, powered by 25 h.p. motors, were selected.

Here is one more example of the leading firms which leave nothing to chance when it comes to an important air moving job. They specify "Buffalo", the fans known for quiet efficiency and dependability for 79 years — the fans with the famous "Q" Factor* built into them.

For sure satisfaction on your next air job — whether it's ventilation, draft, exhaust or air conditioning supply — specify "Buffalo". Your trained "Buffalo" engineering representative in your nearest principal city will be happy to work with you.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

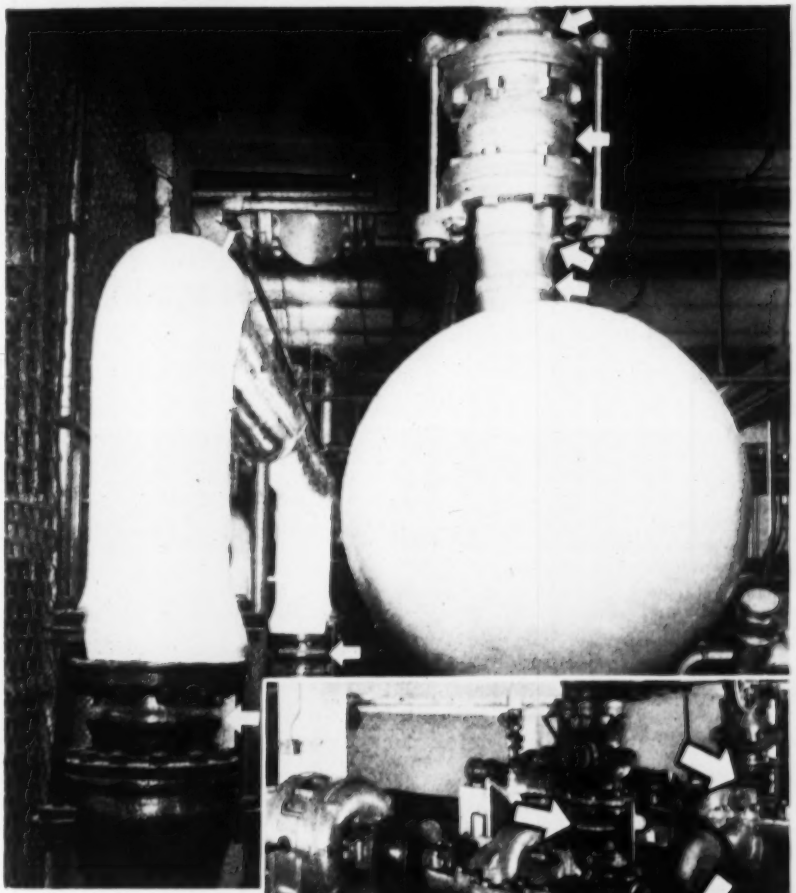
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

FOR SILENT, VIBRATION-FREE AIR-CONDITIONING SYSTEMS

Prevent transmission of compressor noises in circulating lines with U. S. Rubber Expansion Joints



A compressor with expansion joints on the suction and discharge lines. Suction line is at bottom, discharge line at top. Expansion joints were vulcanized to welded flanges at our factory, to handle Freon in the compressors.

These flexible rubber connections for pressure and vacuum pipe lines insulate against vibration and prevent the transmission of noise. They also offset stresses caused by expansion and contraction and misalignment. You will find U. S. Expansion Joints are standard on many of the most up-to-date air-conditioning installations.

A product of United States Rubber Company, these U. S. Expansion Joints have many applications in air conditioning: they are used for the chilled-water lines from the water chillers, and the refrigerant lines from the refrigerating compressors; also the water lines to and from the cooling towers. They are used on the header connections to the condenser and to the cooler and on pipe lines at the circulating water pump.

For handling Freon in compressors, there is a specially-designed U. S. Freon Expansion Joint.

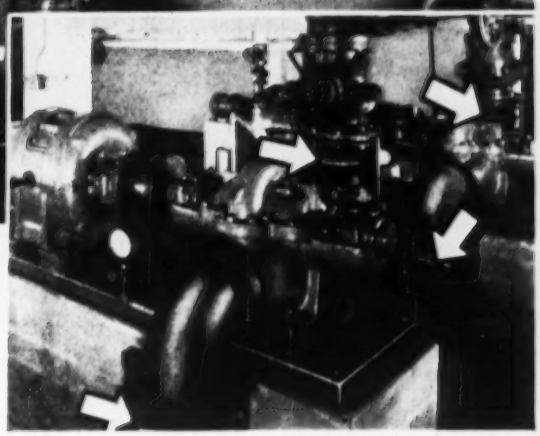


Photo shows expansion joints connected to condenser and cooler and on pipe lines at circulating water pump.

Since they have no moving parts to wear or bind, U. S. Expansion Joints last a long time. Some are still in service after 30 years—a record unmatched by any other expansion joint! U. S. Expansion Joints will solve any pipe line problem caused by noise, vibration and misalignment. They are obtainable at any of the 27 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

QUALITY IS RECOGNIZED AGAIN

Nothing But the Best

FOR LEVITTOWN'S *"Country Clubber"* DE LUXE AIR-CONDITIONED HOMES

- In the Middletown section of fabulous Levittown, Pa., — the world's largest pre-planned community—the exclusive Red Rose Gate neighborhood is now under construction, featuring 702 luxurious homes with central air-conditioning.
- To meet the three-fold requirements of lasting *Beauty*, exacting, quiet *Performance* and quality *Construction*, WATERLOO Registers and Grilles were selected for these homes.
  - *For these same qualities leading architects, engineers and contractors specify WATERLOO for their finest churches, schools, hospitals, government, industrial and office buildings.*

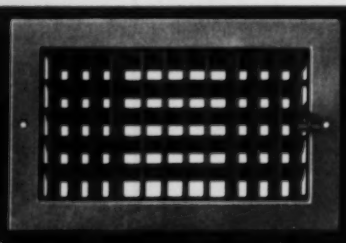
Waterloo
AIR DIFFUSION EQUIPMENT

"Since 1902"

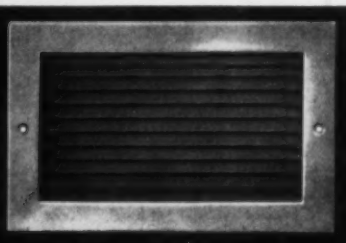
When you must meet air diffusion problems, call freely on WATERLOO'S know-how, gained through 54 years of experience.

WATERLOO'S exceptional delivery service permits meeting exacting production schedules.

A typical Air-Conditioned Red Rose Gate "Country Clubber" home, in Middletown, Levittown, Pa., where WATERLOO — the finest in air diffusion equipment — will be enjoyed.



IVMH SUPPLY REGISTER



3H RETURN AIR GRILLE

In addition to offering "Extraordinary Service", intrinsic beauty and outstanding performance, WATERLOO Registers and Grilles now feature:

New Narrow Stack Depth, permitting use of the more efficient type commercial Register in the home air conditioning field, and INTERCHANGEABLE for use in both commercial and home installations.

New Decor Color Styling in soft beige-gray, which provides a permanent decorative appearance without additional finish.

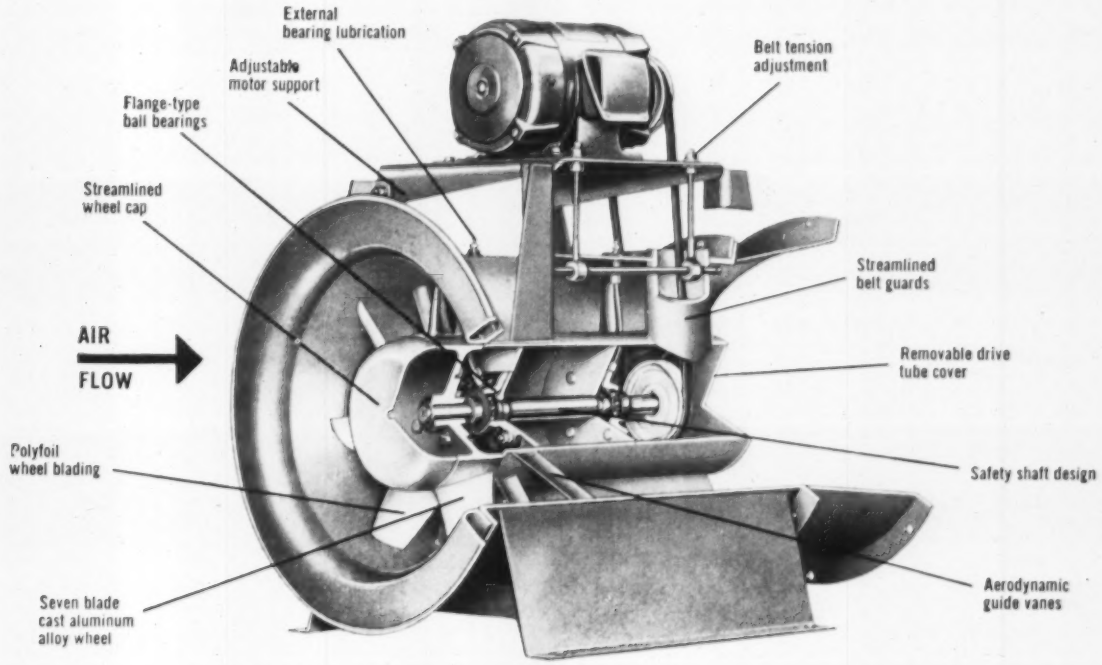
Write for Complete Catalog or Phone Your Nearest Waterloo Representative.

WATERLOO REGISTER CO., Inc.

P. O. BOX 72 WATERLOO, IOWA, U. S. A.

NEW Improved Westinghouse Axial Flow Fans

for Industrial air, fume, vapor handling jobs!



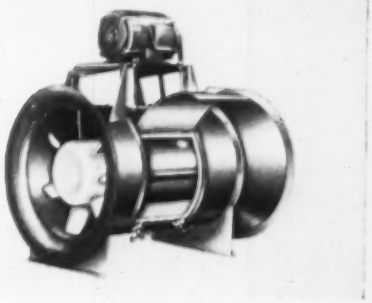
CUTAWAY VIEW OF WESTINGHOUSE AXIFLO® VANEAXIAL FAN FOR GENERAL APPLICATION.

COMPLETE NEW LINE

With: volumes from 1,700 to 100,000 CFM—static pressures up to 3¼"—14 sizes, Vaneaxial or Tube Axial, direct-connected or V-belt driven, with wheel diameters from 15" to 72".

- **Space Saving** . . . compact Axial Flow design permits installation directly into duct work.
- **Improved performance** . . . non-overloading horsepower feature permits use of smaller motors.
- **Least maintenance** . . . rugged practical construction insures continuous trouble-free operation.

For complete application service, call your nearest Sturtevant Sales Engineer, or write Westinghouse Electric Corporation, Sturtevant Division, Dept. 14F, Hyde Park, Boston 36, Mass.



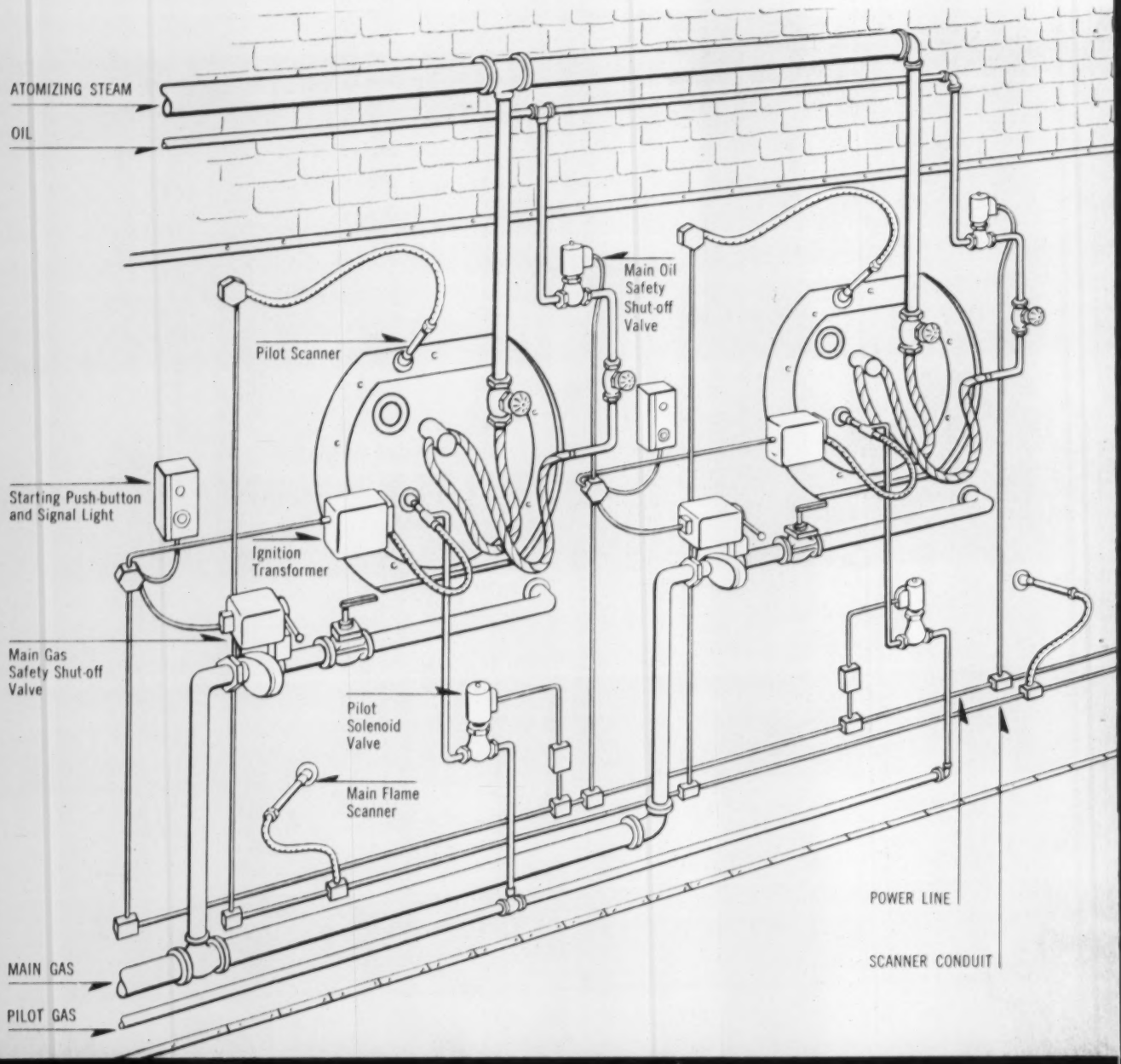
Spray booth Vaneaxial Fan specially designed to provide easy access required for paint spray exhaust!

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU***

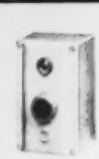
J-80592

NOW, A Really Safe Way to



fireye Interlock System offers you all these safeguards in a single

Alarm Horn


Starting Switch and Pilot Light

Ignition Transformer

Pilot Solenoid Valve

SCANNER ASSEMBLY

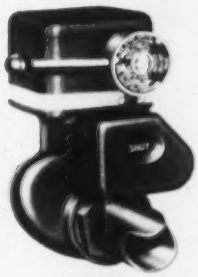
Swivel Mount

Sealing Union

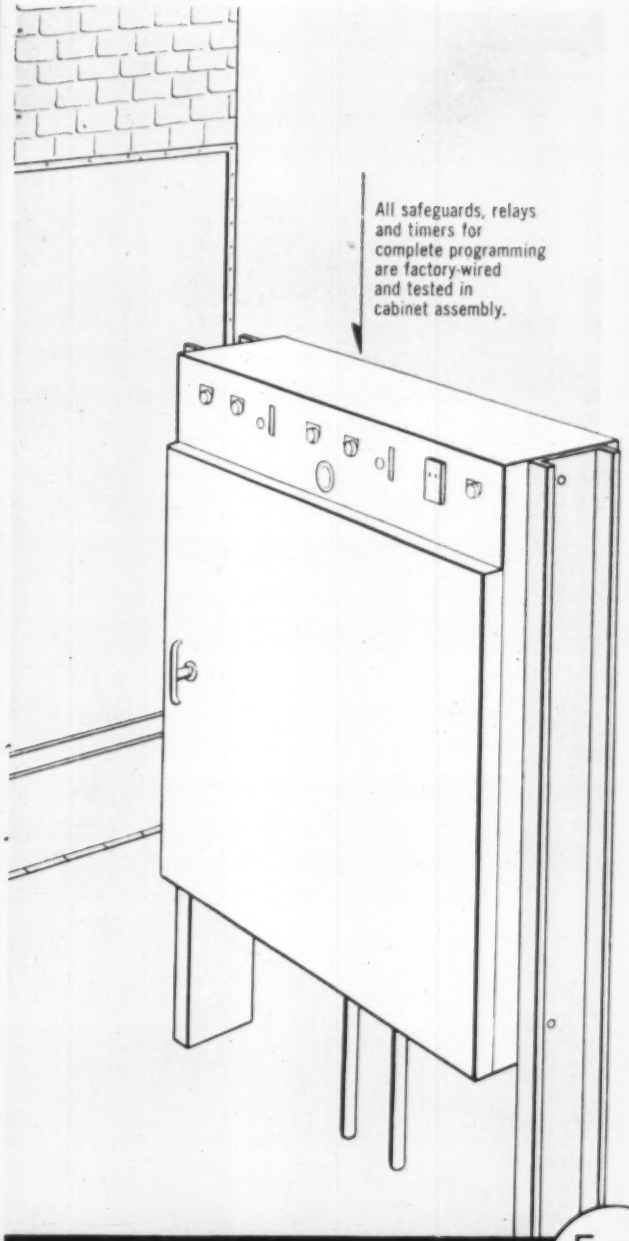
Insulating Tube

Electronic Scanner

Main Oil Safety Shutoff Valve


Main Gas Safety Shutoff Valve

Operate Your Power Boiler



New Fireye "Packaged" Interlock System automatically insures safe light-off and firing.

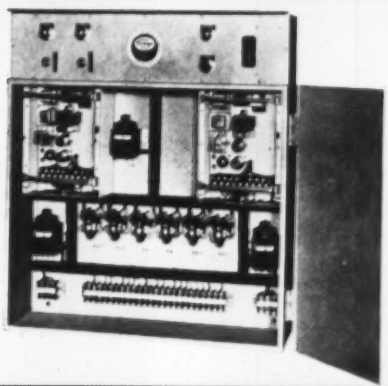
Now, for the first time, you can have a complete "packaged" safeguarding system for your power boiler. This single factory-integrated control system automatically, positively enforces a safe light-off procedure and supervises the flame during firing.

Every stage of lighting-off each burner is precisely controlled by Fireye's system of timers, interlocks, and shutoff valves. And, if the flame goes out, the system shuts off fuel in 2 to 4 seconds . . . and will not allow re-ignition before the combustion chamber is completely purged.

This new Fireye system eliminates the hazards of incorrect light-off and flame failure, which insurance records show are the cause of 85% of all furnace explosions. It can be installed on any multiple burner boiler. Installation supervision by a qualified Fireye engineer is part of our national service, when desired.

For full details, call your local Fireye representative, or use the coupon below.

"package"



Complete Cabinet Assembly

COMBUSTION CONTROL DIVISION
ELECTRONICS CORPORATION OF AMERICA
718 Beacon St., Boston, Mass.

E C A

fireye

Other ECA Divisions: Photoswitch Division • Fireye Division • Macine Division • Business Machines Division • Photoconductor Transistor Division • Military Division

Electronics Corporation of America, Dept. C13-6
718 Beacon Street, Boston 15, Massachusetts

Please send me your new bulletin describing safe start up and firing practices for multiple burner boilers.

NAME

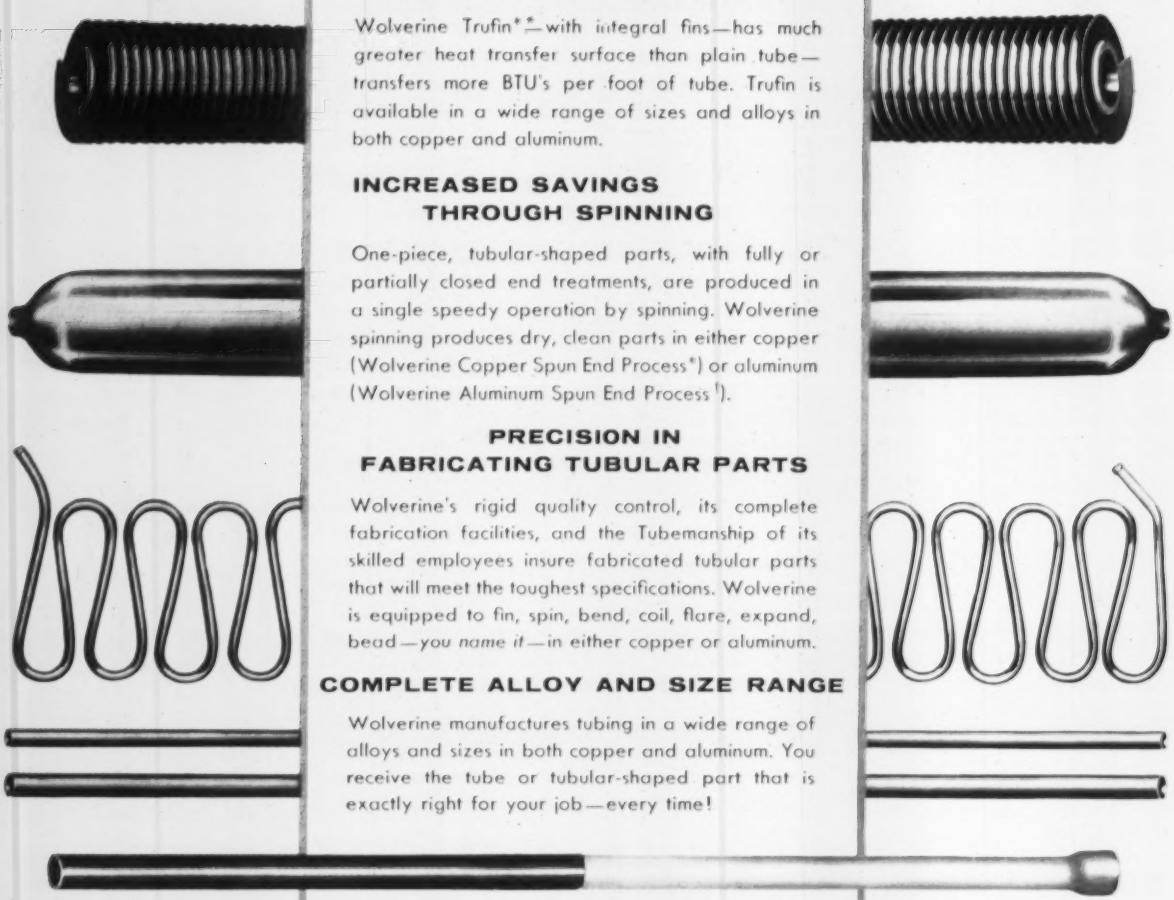
COMPANY

STREET CITY

OUTSTANDING WOLVERINE DEVELOPMENTS

IN COPPER

IN ALUMINUM



INCREASED HEAT TRANSFER

Wolverine Trufin*‡—with integral fins—has much greater heat transfer surface than plain tube—transfers more BTU's per foot of tube. Trufin is available in a wide range of sizes and alloys in both copper and aluminum.

INCREASED SAVINGS THROUGH SPINNING

One-piece, tubular-shaped parts, with fully or partially closed end treatments, are produced in a single speedy operation by spinning. Wolverine spinning produces dry, clean parts in either copper (Wolverine Copper Spun End Process*) or aluminum (Wolverine Aluminum Spun End Process †).

PRECISION IN FABRICATING TUBULAR PARTS

Wolverine's rigid quality control, its complete fabrication facilities, and the Tubemanship of its skilled employees insure fabricated tubular parts that will meet the toughest specifications. Wolverine is equipped to fin, spin, bend, coil, flare, expand, bead—*you name it*—in either copper or aluminum.

COMPLETE ALLOY AND SIZE RANGE

Wolverine manufactures tubing in a wide range of alloys and sizes in both copper and aluminum. You receive the tube or tubular-shaped part that is exactly right for your job—every time!

JOINING DISSIMILAR METALS

Sometimes, manufacturers wish to use both aluminum and copper tube in the same system. Wolverine furnishes handy copper-to-aluminum connectors in both 3/8" and 5/16" tube diameters.

Wolverine Tube, 1461 Central Ave., Detroit 9, Mich.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

* REG. U.S. PAT. OFF.
‡ A PATENTED PROCESS RE. 22465
† PROCESS PATENT APPLIED FOR

***Creative Tubemanship*—IN ACTION!**

DIVISIONS OF CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
CANADA VULCANIZER & EQUIPMENT CO., LTD.
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER CO.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPT., 11 E. 48TH ST., NEW YORK 16, N.Y.

5/56

427 miles of heating dependability

ASSURED FOR N.Y. STATE THRUWAY!

FIRST... By Sarcotherm Weather-Compensated Control Systems for all 40 Toll Interchanges

AND NOW... By Sarco Heating Specialties for 23 Service Areas

ON THE NEW YORK STATE THRUWAY, there are now 23 restaurant-gas service areas and 40 toll interchanges along the 427 miles of this great vehicular artery...from New York to Buffalo.

Each of these service areas and toll interchanges has its own heating plant. Therefore, dependability of equipment is of vital importance...for faulty operation or breakdowns would mean heating headaches and call-backs all along 427 miles of highway.

That is one of the principal reasons for the installation of Sarcotherm Weather-Compensated Control Systems for the hot water heating of *all* 40 toll interchanges...and of Sarco Steam Heating Specialties for *all* the 23 service areas now completed.

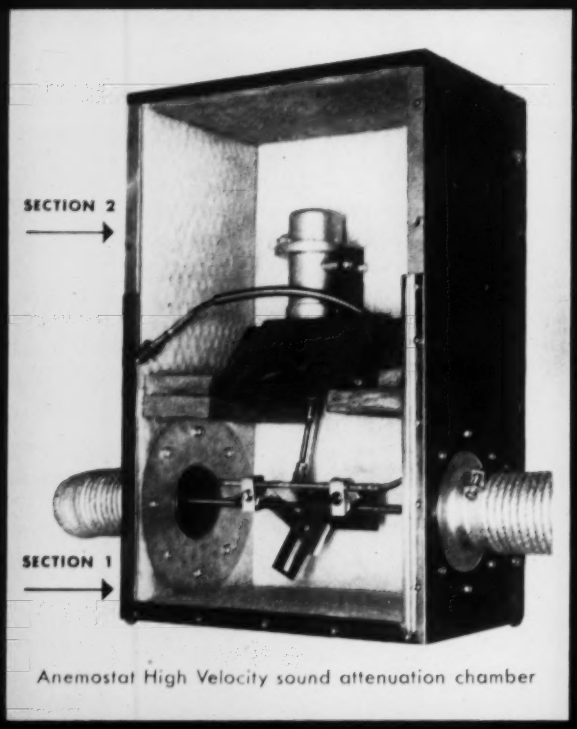
For undivided responsibility on your installations, specify and order from one "Complete Line" source...SARCO-SARCOTHERM...heating specialties, temperature regulators, condensate and vacuum pumps, finned tube radiation, and weather-compensated control systems for steam and hot water heating. Write for catalogs.

SERVICE AREAS—Architect: Eggers and Higgins. Consulting Engineers: Jaros, Baum & Bolles. Heating Contractors: Joseph Davis, Inc.; Mechanical Installations, Inc.; Harry Hoyle Contracting Co.

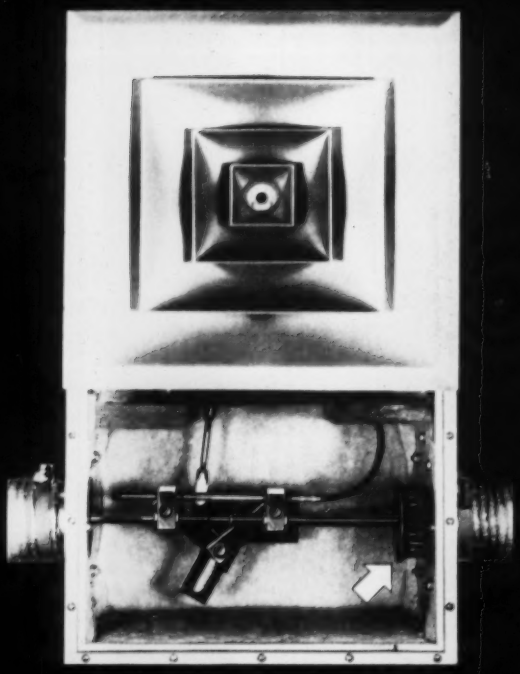
TOLL INTERCHANGES—Mechanical Engineers: Syska & Hennessy, Inc. Heating Contractor: Mechanical Installations, Inc.

SARCOTHERM

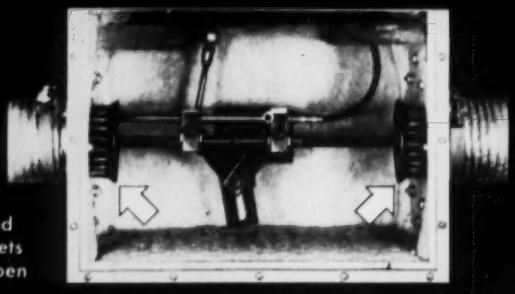
Sarcotherm Controls, Inc. • Sarco Company, Inc.
Empire State Bldg., N. Y. C.



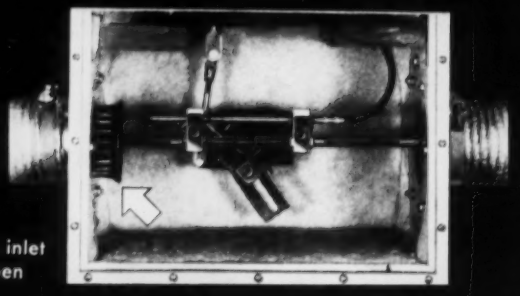
Anemostat High Velocity sound attenuation chamber



Hot inlet open in Section 1.
Anemostat in place covers Section 2



Hot and cold inlets 50% open



Cold inlet open

How to mix and diffuse high velocity air automatically

The Anemostat High Velocity sound attenuation chamber is divided into two sections. Both hot and cold air from the main risers enter Section 1, which is an acoustically lined blending chamber, in which the volumes of air are controlled by the Anemostat serrated rocket-socket valves. When the thermostat is set, the rocket-socket valves move slowly back and forth, thereby adjusting the volume of air supplied through the hot and cold inlets. The velocity of the air which enters Section 1, at from 3500 to 6000 fpm, is automatically reduced by expansion.

As the blended air meets the temperature requirements of the thermostat, it passes through a baffle arrangement into the acoustically lined Section 2 of the chamber, further reducing the db rating of the air.

The air then passes through the Anemostat Air Diffusers, where the aspiration effect causes mixing of room and supply air within the diffuser, resulting in further temperature equalization. The diffuser then delivers to the occupants of the room draft-free air at the desired temperature.

The Anemostat All-Air High Velocity distribution system offers other important advantages. It can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. Furthermore, Anemostat round, square and straightline diffusers with high velocity units blend into a wide variety of architectural designs.

Write for 1956 New Products Bulletin and Selection Manual 50 to Anemostat Corporation of America, 10 E. 39 Street, New York 16, N. Y.

Anemostat: The Pioneer of All-Air High Velocity Systems

AC-1337

FANCY-FREE FAN: *IM-pak

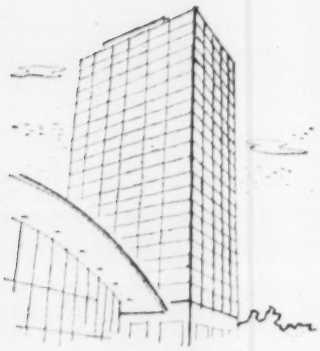
IM-pak CHANGES TO ANY OF 4 POSITIONS—WHILE IN PRODUCTION! "Fancy-Free" is the word for Utility's new IM-pak Blower with Interchangeable Mounting—but it's fancy-free in a way you'll like! IM-pak's complete flexibility gives you an across-the-board stock that covers up to 98% of blower applications for residential air-moving equipment. The key is the Interchangeable Mounting. The two housing supports and motor mount bracket are shipped unattached to the unit, but with all hardware needed for rapid installation. Simply adjust the angle of discharge to any of *four* positions, and quick as a wink, the job is done. No oil cup problems, due to IM-Pak's sealed ball bearings; and the blowers are also available with a specially designed interchangeable sleeve bearing mount which is easily adjustable and permits time-saving production-line switches. IM-pak is sufficiently fancy-free to adapt to your manufacturing needs—without top-heavy inventories of blowers or many unassembled parts. Of course it has all of Utility's famed quality engineering built right in . . . quality that complements the excellence of your own equipment. Proof again that—*YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE!*

A Division of Utility Appliance Corp.

UTILITY FAN CORP. *911 East 59th Street, Los Angeles 1, California*

MANUFACTURERS OF HEAVY AND STANDARD DUTY BLOWERS FOR HEATING, AIR CONDITIONING AND VENTILATING INSTALLATIONS. PRODUCERS OF BLOWERS AND BLOWER PARTS FOR ORIGINAL EQUIPMENT MANUFACTURERS. WRITE FOR CATALOGUE DATA.

AC-1337

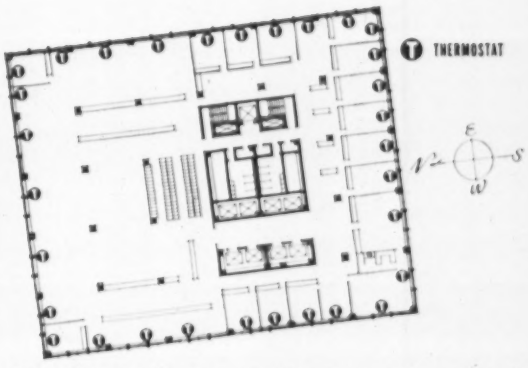


Honeywell Customized Temperature Control—a case history

How Honeywell helps give Denver's

Mile High Center office building, Denver. Owners: Webb & Knapp and George A. Fuller Company. Architects: I. M. Pei & Associates; Kahn & Jacobs and G. Meredith Musick. Consulting engineers: Jaros, Baum & Bolles; Severud-Elstad-Krueger. General contractor: George A. Fuller Company. Prime mechanical contractor: Kerby Saunders, Inc. Plumbing and heating contractor: Crabb Plumbing & Heating Co. Electrical contractor: Fishback & Moore.

Remarkable sense of space is present in outside offices such as this one, occupied by Webb & Knapp senior vice president, Arthur Rydstrom. Open effect is created by strip windows at floor level and larger glass panels above. Despite such free use of glass, comfort is constant. In offices tenants need only dial their choice of temperature; the Honeywell Customized Temperature Control installation then maintains it accurately and efficiently.



Individual office temperature control is indicated in this typical Mile High Center floor plan, showing Honeywell thermostat locations. Flexibility and quick response of the Honeywell Customized installation helps solve another problem, too. At Denver's elevation, one side of the building often needs heat while the other needs cooling. Electronic solar thermostats on the roof activate cooling according to changes in the direction of the sunlight striking the building.

Mile High Center ideal comfort

Tenants of imposing new office building may choose individual comfort preferences

BUSINESS quarters completely modern in concept are provided by the new 23-story Mile High Center office building that dominates Denver's skyline.

Ideal indoor weather was assured by the building's planners. For they chose a Honeywell Customized Temperature Control installation to govern the year-round air conditioning system, giving tenants individual comfort control.

Adjoining the central structure is a three-level transportation building with a lower level concourse where shops and restaurants are located. Because of the flexibility of Honeywell controls, customized comfort is enjoyed throughout Mile High Center—from lofty offices to lower level shops.

That's what "customized" means—a control installation fitted to the needs of the building and its occupants, in heating, cooling, ventilating and humidity control.

True customized control can be provided only by Honeywell. Because only Honeywell manufactures all three types of controls—pneumatic, electric and electronic. Hence only Honeywell is in a position to make truly objective recommendations.

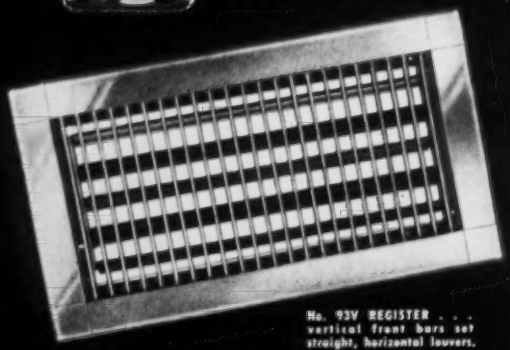
Whether it's an office building, factory, bank or store—any building of any size, new or existing—Honeywell Customized Temperature Control can help solve your clients' problems of heating, ventilating, air conditioning and industrial control.

For full details on Honeywell Customized Temperature Control, and the economical Periodic Maintenance Plan, call your local Honeywell office. Or write Honeywell, Dept. HA-6-65, Minneapolis 8, Minn.

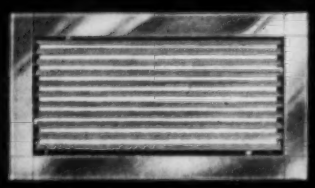
MINNEAPOLIS
Honeywell

Customized Temperature Control

FIXT-*AIRE* . . .



No. 93V REGISTER . . . vertical front bars set straight, horizontal louvers.



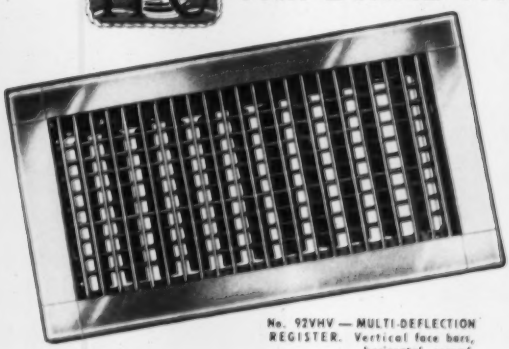
No. 94A GRILLE . . . horizontal face bars set at 22° angle for up or down deflection.

. . . return air registers and grilles designed to complement and harmonize with the TRIPL-AIRE line. Registers have a single bank of face bars in fixed vertical or horizontal position, and feature the same opposed louver construction for positive volume control found in TRIPL-AIRE units. Grilles are available with horizontal face bars set at 22° angle for up or down deflection where desired. One-piece sizes up to 36" x 30".

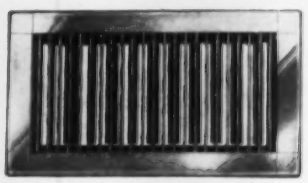
CONVENIENT CATALOG GIVES COMPLETE DETAILS AND ENGINEERING DATA . . .
Available from H&C Jobbers or write direct.

MEMO:
See The New H&C Line
That's Gaining Such
Unusual Acceptance For
Commercial Installations

TRIPL-*AIRE* . . .



No. 92VHV — MULTI-DEFLECTION REGISTER. Vertical face bars, horizontal secondary bars, vertical louvers. Also available without valve No. 92VHO.



No. 92VOV — SINGLE DEFLECTION REGISTER with vertical face bars and louvers. Also available without valve, No. 92VOO.

. . . is gaining popularity, because wherever these units are installed they "do the job", and do it right. And that's because in this one basic line of 26 standard sizes there are 260 possible horizontal and vertical deflection combinations . . . designed to provide any air flow pattern required. No need to compromise when you use TRIPL-AIRE. The ten TRIPL-AIRE combinations are available in twenty-six standard sizes, up to 36" x 12", as well as in intermediate sizes, up to 36" x 36", to order. Front adjustments control face bars and louvers, and opposed louvers permit absolute volume control with equal air distribution over entire face. Top quality "Decorator Gray" enamel finish. H & C Jobbers have complete details.

HART & COOLEY MANUFACTURING CO.
DEPT. 2-AC, HOLLAND, MICHIGAN

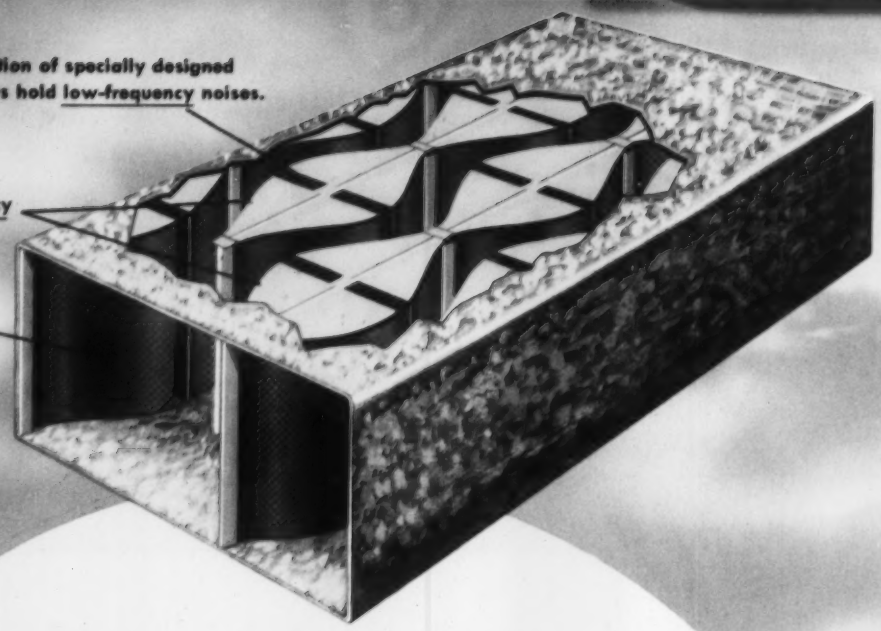
OUT OF THE JET AGE comes the most efficient solution to air conditioning noises

KOPPERS Aircoustat Sound Traps

- As Much as 50% Less than the Cost of Ordinary Lining!
- Acoustical Performance Guaranteed!
- Easy to Install!
- Lower Labor Costs and Less Installation Time!
- Pre-Engineered — No Layout or Design Headaches!
- Greater Customer Satisfaction!
- Fits Acoustically if it Fits Geometrically!

Remarkable new AIRCOUSTAT was created by the experience gained in developing sound control equipment for aviation and other industries. Koppers Industrial Sound Control engineers design sound-deadening enclosures for the testing of jet engines . . . machine enclosures, sound-proof foremen's offices, Acoustiphone booths, sound traps and many other sound control devices. From this unmatched sound control "know-how," Koppers has produced the most advanced and most effective sound control method for air conditioning systems . . . *Jet Age AIRCOUSTAT!*

Discover how AIRCOUSTAT works . . . what it is . . . on the next page


Combination of specially designed resonators hold low-frequency noises.
Periodic internal structure dampens middle-frequency noise.
Carefully-selected, sound-absorbent material suppresses high-frequency sounds.

KOPPERS AIRCOUSTAT SOUND TRAPS ELIMINATE AIR CONDITIONING NOISE OVER THE ENTIRE AUDIO-FREQUENCY RANGE!

Most Effective Sound Control Method!

A single 7-foot AIRCOUSTAT unit deadens all noise frequencies as effectively as 100 feet of ordinary duct lining. Flow resistance and pressure drop are lower.

Simplified Installation

AIRCOUSTAT sound traps are easy to install . . . no special tools are required. Units fit any size of duct within the range of panel sizes . . . adapt to any shape of duct. You can install AIRCOUSTAT to reduce noises only in certain selected areas . . . or to silence an entire system.

Costs up to 50% Less!

AIRCOUSTAT saves you man-hours and labor costs. You can ship ducts nested together and store them outside on the job site. Pre-engineering saves you layout and design time. Fitting AIRCOUSTAT units is easy because they're not dependent on the size of the duct cross-section. You have a choice of 4 series and 19 standard sizes of AIRCOUSTAT.

For Every Application

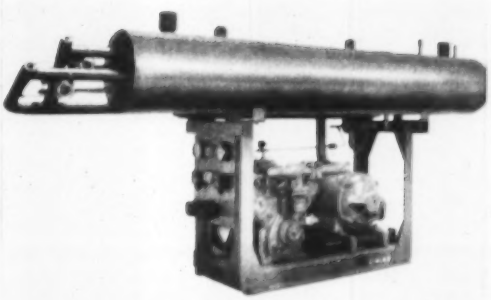
AIRCOUSTAT units eliminate air conditioning noises in applications ranging from general offices to recording studios . . . including private offices, conference rooms, auditoriums, sleeping quarters, stores, hotels and hospitals. For more details on the sound control unit that's years ahead of the field, *AIRCOUSTAT*, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6206 Scott St., Baltimore 3, Maryland.

KOPPERS

INDUSTRIAL SOUND CONTROL

Koppers Company, Inc., Metal Products Division
Industrial Sound Control Department
Engineered Products Sold with Service

Florida motel orders "seconds" on Worthington air conditioning



Low-cost operation of Worthington packaged liquid chillers stems from exact matching of capacity control to load requirement. Easy installation, long life and wide selection are other key features.

Providing an attractive climate indoors and out has paid off so well for the Azure Tides Motel that they're adding a second building.

The cool, comfortable indoor climate is provided by Worthington's 25-ton packaged chiller (at left) and 15-ton condensing unit. So sold on Worthington air conditioning are the Azure Tides people that the new structure will be cooled by a second Worthington central system consisting of a 25-ton package chiller and a 15-ton condensing unit.

Located on Sarasota's Lido Beach, this handsome two-story motel owes its growing popularity to a choice location, modern comfortable appointments and service geared to the guests' convenience.

Both the original 50-unit building (above) and the 38-unit addition (three-story construction with elevator, modern restaurant and cocktail lounge) were blueprinted by Designer Frank C. Martin and built by General Contractor Charles Ongheri of Sarasota.

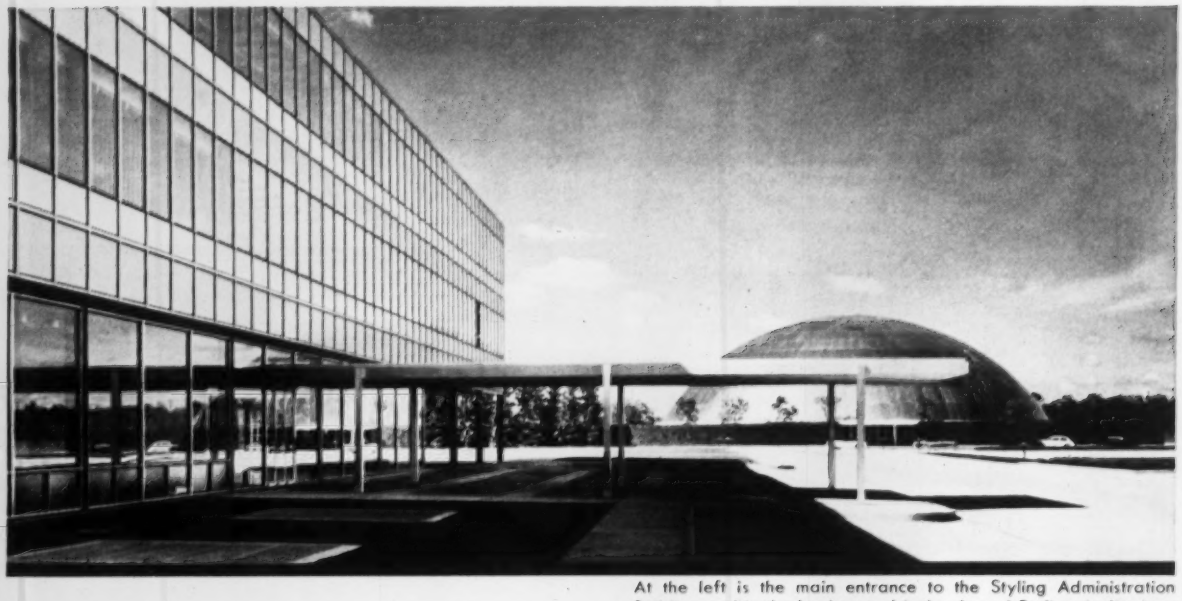
For information on air conditioning units to meet your residential, business or industrial needs, call your local Worthington distributor. Or write for Bulletin WP-1099 B48 to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A-6.70-R, Harrison, New Jersey.

A-670

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

THERMOTANK'S *HIGH-VELOCITY* AIR CONDITIONING SELECTED BY FABULOUS GM TECHNICAL CENTER



At the left is the main entrance to the Styling Administration Building and in the background is the domed Styling Auditorium, two of the seven buildings air conditioned by Thermotank, Inc.

This executive office in the Research Administration Building shows a typical installation of Thermotank's custom-designed air diffusers with integrated sprinkler heads.

IN co-operation with General Motors' engineers, Eero Saarinen & Associates, architects, and Smith, Hinchman & Grylls, Inc., architect-engineers, Thermotank, Inc., helped design a new high-velocity, double-duct air conditioning system for seven of the buildings in the magnificent General Motors Technical Center. Using techniques developed through 30 years' experience in moving air at high speeds through tight spaces, Thermotank engineers provided a streamlined duct design with noiseless Thermo-Reg mixing boxes and high-velocity ejection ceiling diffusers, which incorporate sprinkler heads and are integrated with the ceiling acoustical treatment. Thermotank invites inquiries about further details of this advanced system of high-velocity, year-'round air conditioning.

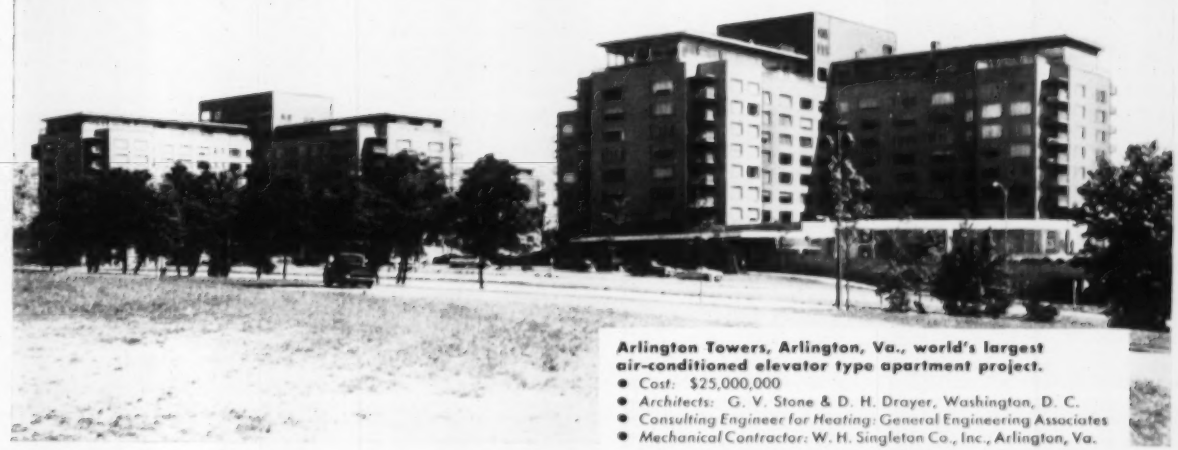
GENERAL MOTORS TECHNICAL CENTER

THERMOTANK INCORPORATED

Air Conditioning Engineers & Consultants • Air Conditioning Products

11191 LAPPIN AVENUE • DETROIT 34, MICHIGAN

MAMMOTH NEW ARLINGTON TOWERS TAKES PLENTY OF HEATING!



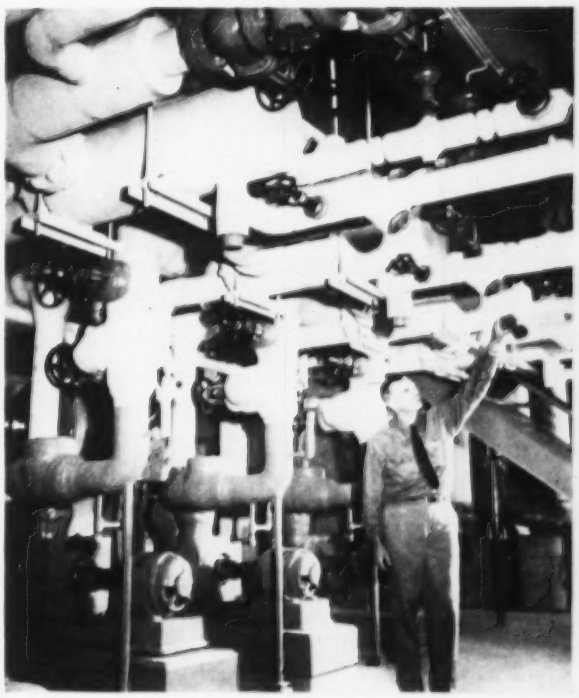
Arlington Towers, Arlington, Va., world's largest air-conditioned elevator type apartment project.

- *Cost:* $25,000,000
- *Architects:* G. V. Stone & D. H. Drayer, Washington, D. C.
- *Consulting Engineer for Heating:* General Engineering Associates
- *Mechanical Contractor:* W. H. Singleton Co., Inc., Arlington, Va.

. . . and 20 GENERAL Converters easily supply it for all 1684 apartments

Comfortable suburban living is the theme at beautiful new Arlington Towers Apartments. And an important part of the "comfort picture" is the heating of 869 efficiency apartments, 755 one-bedroom apartments, and 60 penthouses. GENERAL Converters do the job nicely. A compact bank of converters in each of the project's four spacious buildings provides high efficiency heat transfer from the steam lines to the circulating hot water system. There's always plenty of heat for each apartment.

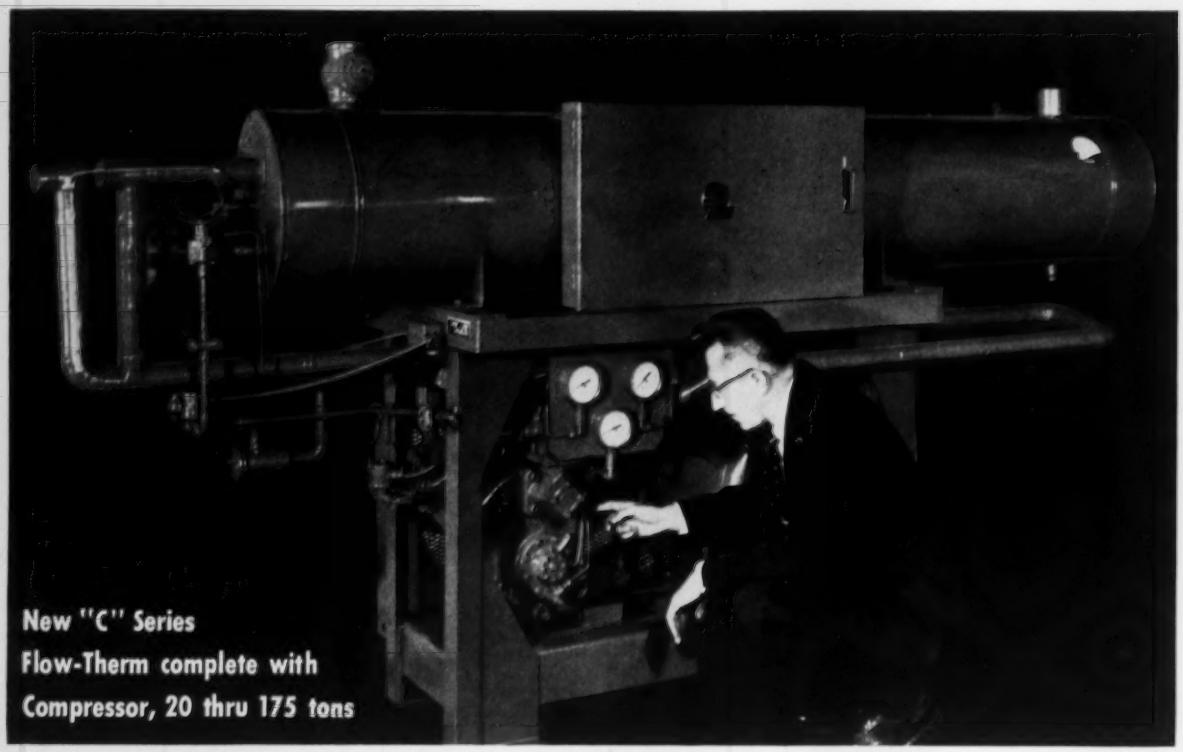
This modern hot water heating system illustrates a typical application of GENERAL Converters in new apartment construction. Other successful installations of GENERAL Products are operating in all types of buildings from cottages to skyscrapers. Put GENERAL efficiency into *your* next job. Write for Catalog 61. General Fittings Co., Box 151E, East Greenwich, R. I.



One of four centralized banks of steam to water GENERAL Converters that supply heat for Arlington Towers. Four of the five converters in each building supply 160° F water at 190 to 270 g.p.m. The fifth in each bank (not shown) supplies 200° water at 65 to 80 g.p.m.

GENERAL FITTINGS COMPANY

Manufacturers of Instantaneous Water Heaters, Converters, Fuel Oil Heaters, and Heating Specialties



New "C" Series
Flow-Therm complete with
Compressor, 20 thru 175 tons

NEW! complete!... compact!
...the Flexible *Acme* FLOW-THERM®

Here's the new, compact, packaged liquid chiller, complete with compressor, that will add new possibilities to your air conditioning plans . . . Acme's "C" Series FLOW-THERM designed specifically for modern refrigerants. Constructed with proven Acme components, it fits all the requirements of architects, consulting engineers and contractors for large capacity efficiency and easy installation.

A major component of this new "package" is Acme's great, new Dry-Ex®, a smaller, lighter water chiller that packs 25% more capacity in every cubic foot. The reason, a new advancement in refrigerant tubing, is described briefly below. Compressor, condenser and heat exchanger are all selected to give maximum performance in a space-saving, economical unit.

The Flow-Therm is completely assembled and tested, ready for simple connections. You save the engineering cost of a built-up system, get fast, economical installation and more dependable performance. Proven design, correct controls, and factory-installed piping and wiring mean long, trouble-free life.

FLOW-THERM proven as Heat Pump.

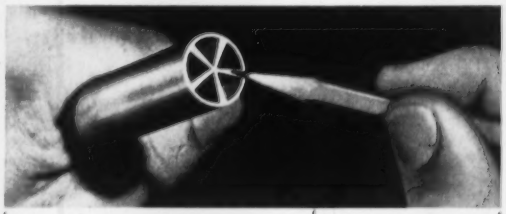
Heat Pump applications have been successful in a wide range of climates. Factory modifications for heat pump use are simple and inexpensive.

WRITE TODAY FOR THE NEW FLOW-THERM CATALOG.

ACME INDUSTRIES, INC. JACKSON, MICHIGAN

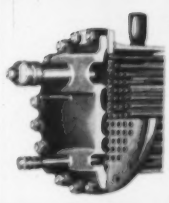
gives you these five star features

- ☆ ***Simplifies engineering***
- ☆ ***Fast, economical installation***
- ☆ ***Space-saving size***
- ☆ ***Balanced, proven components***
- ☆ ***Less maintenance***



*Star feature**

of the new Acme Dry-Ex — key component of the "C" Flow-Therm — is a new copper tubing with a star-shaped aluminum insert that doubles the heat transfer surfaces. Tubes extend straight through to multi-pass heads at each end. No bends, no soldered joints — no leaks!



Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

*Patent applied for

Many extra advantages at no extra cost with this low-pressure pipe covering

Insulating efficiency of ½" thick Armaglas* Low-Pressure Covering is equal to or better than ¾" or 1" thickness of ordinary materials. Lightweight, thin wall design speeds handling and saves space in crowded quarters. Tough glass fiber composition eliminates cracking and crumbling during application. High shrinkage resistance keeps joints tight and neat looking. White vapor barrier jacket needs no further finishing on cold water, hot water, or low-pressure steam lines. Made in molded half sections for pipe and tubing to 12".

Armaglas is one of the quality products in the complete line of Armstrong Industrial Insulations. Armstrong also offers you a complete contracting service, geared to install these products economically and efficiently.

For complete information on Armaglas, send for free booklet. Booklets on other Armstrong Insulations also supplied on request. Check the ones you want on the coupon below.

* Trade-Mark. Manufactured for Armstrong by Owens-Corning Fiberglas Corp.

Armstrong

INDUSTRIAL INSULATIONS

☐ Armstrong Armaglas Insulations for Pipes, Tanks, and Vessels

☐ Armstrong Insulcolor®, Weatherproof Coating in Eight Colors

☐ Armstrong LT Cork Covering, a New Type Cold Line Insulation

☐ Armstrong Armaflex**, a New Flexible Insulation for Piping

® TRADE-MARK

Armstrong Cork Company
2006 Sherman St.
Lancaster, Penna.

Please send me the free booklets checked. ☐

Please have an Armstrong representative call. ☐

Name .....

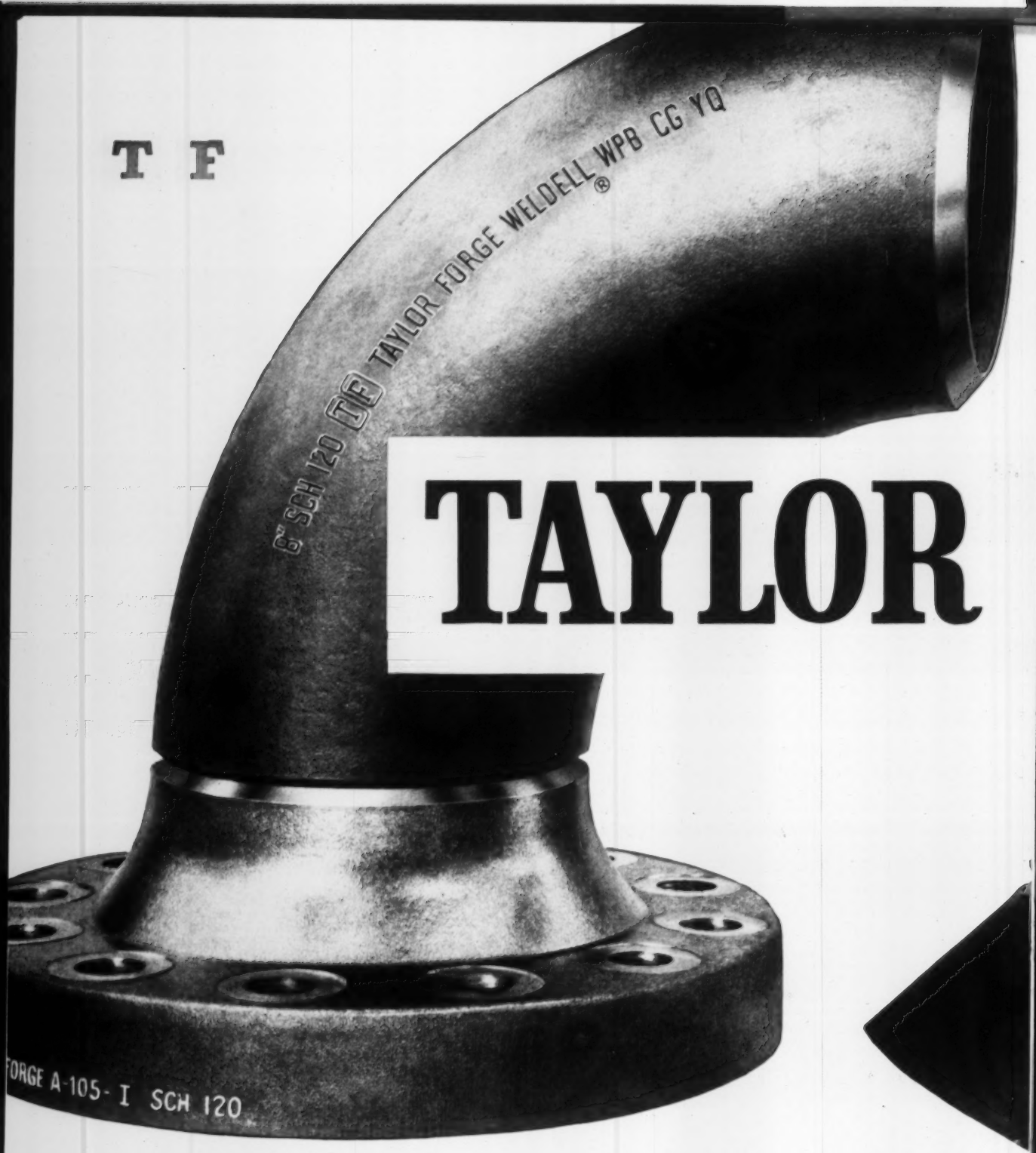
Position .....

Company .....

Address .....

City ..... Zone ..... State .....

T F



TAYLOR

Welding nozzles

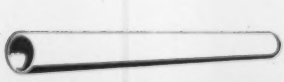
T.E.M.A. flanges and channels

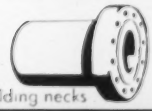
Multiple outlet headers

Production forgings

Venturi reducers

Spiral weld pipe


Large diameter electric weld pipe

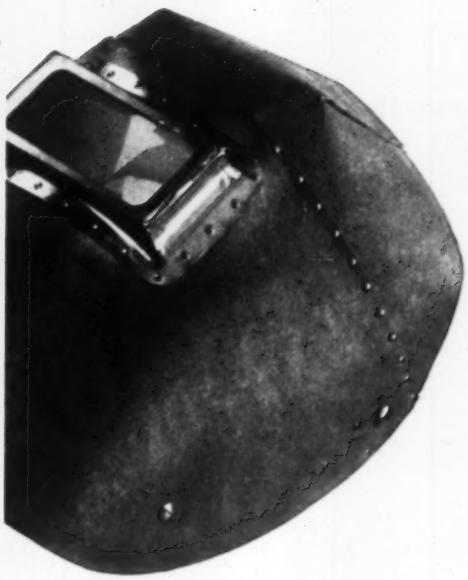

Welding necks

Here is the Industry's

Here's a rugged pair ready to be teamed up for a tough job

For utmost value on any piping job insist on

FORGE Welding Fittings and Forged Flanges



* Backed by 55 years' experience
* Engineered for unvarying accuracy
* Forged for maximum strength and stamina
* Guaranteed to meet all American Codes and Standards
* Available in every size, type, thickness, pressure rating and material

To be sure... turn to Taylor Forge
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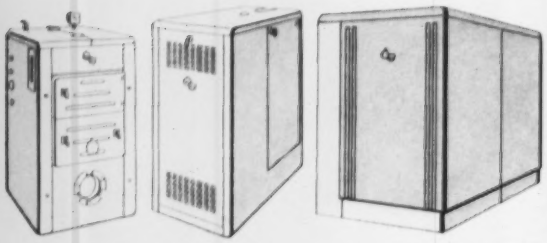
He carries a full stock of Taylor Forge Welding Fittings and Forged Flanges and can supply your needs promptly. He's a good man to know for he understands piping and through him you have available the services of Taylor Forge engineers for help and advice on any piping problem.

Here is the Industry's Most *Complete Line* of Oil Heating Boilers and Units

A fully integrated line of Oil Heating Boilers and Units, in both cast iron and steel, is now available under the famous and dependable National-U.S. brand name . . . boilers and units especially designed and engineered for modern oil heating at its finest . . . to meet all heating requirements from small homes to large commercial and industrial buildings.

Specialized Boilers Exclusively for Oil Firing

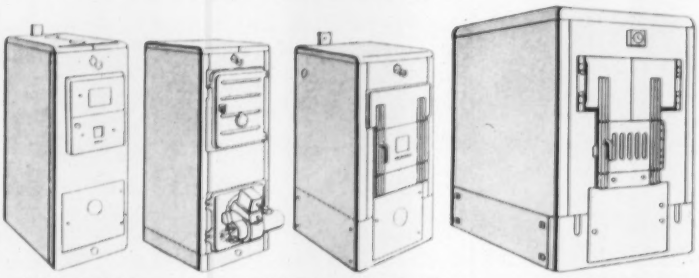


"46" Series Oil Heating Boiler (Wet leg type).

"20" Series Oil Heating Boiler (Wet base type).

"25" Series Oil Heating Boiler (Wet base type).

Cast Iron Boilers for Automatic Firing and Oil Heating Units



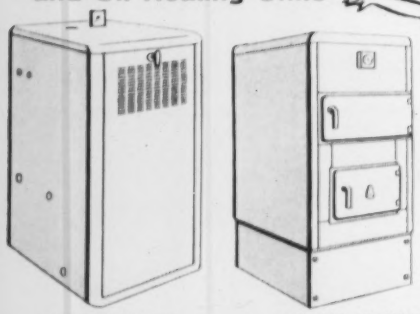
"10" Series Boilers

"12" Series Boilers

"27" Series Boilers

"32" Series Boilers

Steel Boilers and Oil Heating Units



"17" and "24" Series Residential Steel Oil Heating Units

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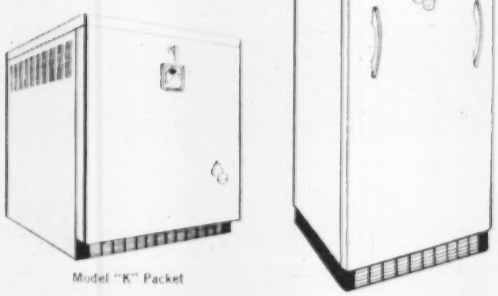
All types of modern, National-U.S. Heat Distributors work effectively with oil-fired boilers—Baseboard and Convectors (both cast iron and non ferrous), Cast iron tubular and wall radiators and Fintube radiation.

NATIONAL-U. S. PACKETS . . . automatic, all-in-one home heating units (oil-fired)



Model "K" Packet

Model "U" Packet

All sizes of residential and commercial conversion oil burners are also available.

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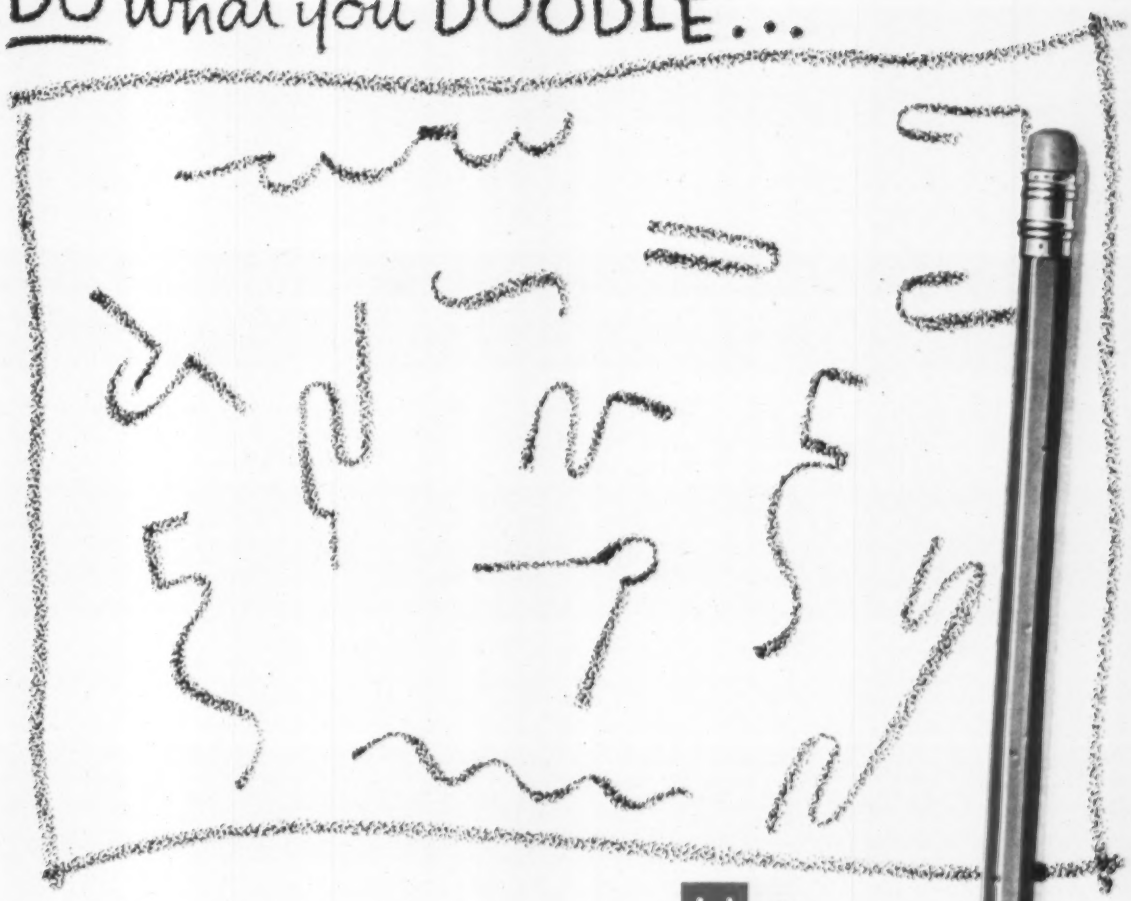
CORPORATION

HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania
Sales Offices and Representatives in principal cities

Write for bulletins giving full information and engineering data with ratings on each individual series of National-U.S. Oil Fired Boilers or Units.

All National-U.S. Oil Heating Units are rated by laboratory tests in accordance with the Rating Code of The Steel Boiler Institute and The Institute of Boiler and Radiator Manufacturers, and conform with the ASME Boiler Construction Code of The American Society of Mechanical Engineers.

DO what you DOODLE...



with Wheeling SOFTITE®

. . . the coating won't crack, peel or flake regardless of *how* you fabricate it. It will take a Pittsburgh Lock as easily as it will a simple angle . . . and look none the worse for it. Matter of fact the coating will take anything the base metal will . . . and still come out looking as smooth, unbroken and shining-bright as ever. That's because Wheeling makes SOFTITE in a new and different way with the zinc coating tighter than ever before possible.

As a result, seams stay tighter, joints are surer, jobs look better, last longer, give utmost customer satisfaction.

Next time *you* need sheets remember, only *Wheeling* makes SOFTITE, the tightest-coated galvanized sheet available. Get in touch with the Wheeling warehouse or sales office nearest you for full details.

This is Wheeling's Detroit warehouse. Other Wheeling warehouses and sales offices are strategically located throughout the country. They all offer immediate delivery of warehouse-stocked Wheeling items such as SOFTITE Cop-R-Loy Galvanized sheets, Galvanized Furnace Pipe, snap lock or closed seam Perimeter Heating or Air Conditioning Pipe, and accessories.

Wheeling

WHEELING CORRUGATING COMPANY, WHEELING, WEST VIRGINIA

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TRIBOROUGH BRIDGE & TUNNEL AUTHORITY

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Heating, Ventilating & Air-Conditioning Contractor
ALMIRALL & CO., INC.

Another Famous Showplace Equipped with

POWERS *Control Systems*

for Heating, Ventilating and Air Conditioning

In this $35 million structure there's a 26 story office building, a large underground garage, and a 9 acre four level exhibition area with the most modern facilities obtainable. Meeting rooms accommodate 25 to 10,000 people. A million visitors and exhibitors annually will enjoy its air-conditioned comfort.

In the office building, individual space control is obtained with more than 550 Powers Heating-Cooling Thermostats regulating 1400 unit air-conditioner valves.

In the Coliseum exhibition halls and other spaces, conditioned air is regulated by seven Powers Control Panels, one of which is illustrated below.

Flexibility of Powers Control meets the varied needs of this unique building. For example, two separate air-conditioned systems are used, one for the Coliseum and one for the office building. Ten cooling towers on the Coliseum roof provide condenser cooling water for 4100 tons of refrigeration. Four centrifugal compressors carry the cooling load. Interconnection of the cooling and chilled water circuits permits refrigeration compressors to serve either the offices or Coliseum, preventing downtime of air-conditioning if a compressor fails.

On the periphery of the office building under the window type unit air-conditioners are supplied with high pressure primary air. Interior zones are served by a high velocity air system using warm and cool air mixing boxes with ceiling diffusers and side wall outlets.

The large Coliseum areas are supplied by high velocity single zone air systems while the small meeting rooms, office areas, etc. are served by low pressure fan units and by high velocity double duct systems.

Consult Powers on your next control job. Be it large or small, if quality, superior performance and engineering know-how are important, call your nearest Powers office.

POWERS CONTROL

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in Chief Cities in U. S. A., Canada and Mexico*

65 Years of Automatic Temperature and Humidity Control

Left: Some of the 140 foreign cars in the auto show from Britain, Germany, France, Italy and Sweden.

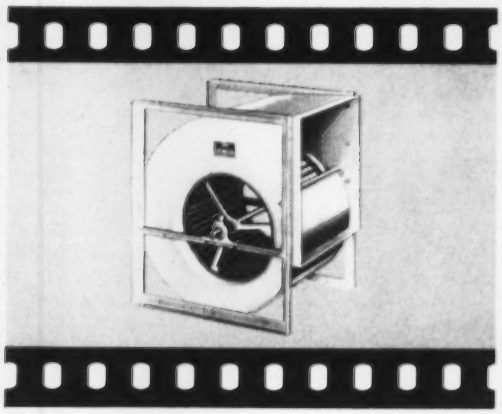
Right: Switzerland, one of 50 foreign countries at the International Stamp Show, provided visitors with a long special glass top table beneath which stamps were displayed on two moving belts.

4 exhibition floors may be used singly for four separate simultaneous shows or any combination of floors may be used together.

(c75)

MAN OF MANY ROLES

FAN OF MANY ROLES



Remember Lon Chaney? He gave chills galore to silent film fans in "Phantom of the Opera"... moved from role to difficult role at the drop of an opera cloak, earning him his stage name, "Man of A Thousand Faces."

At Utility, we have a blower as nimble as Mr. Chaney at changing roles—at your "direction." Known off location as the 4-Way Discharge Blower, **on** location it positions quickly in any one of four positions—top horizontal, top vertical, bottom horizontal or bottom vertical. If we wanted to stretch a point, there are actually **eight** positions, since the fan faces left or right at any of the above angles.

The key to the stellar performance of Utility's 4-Way Discharge Blower is the rigid frame. You simply place the fan in the desired discharge position and the job is done, without bolts or screws or costly sheet metal work. This rigid frame also adds a bonus of strength and stability to the installation. Inventory-wise it makes sense. Available in single and double widths, this blower can take care of many jobs without emergency re-ordering or "hand fashioning" on the job.

The quality is there—and it's all Utility! One-piece wheel for rigidity, long life and super-quiet operation. And due to Utility's advanced production techniques, this "fan of many roles" is priced with the lowest. Proving again that when quality and price must get together, Utility is always the logical answer.

A Division of Utility Appliance Corp.

UTILITY FAN CORP

911 East 59th Street, Los Angeles 1, California

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

Typical plant ceiling showing foil-faced Pittsburgh Fiber Glass insulation in position.

"Pittsburgh Superfine is easiest to apply... most efficient insulation for steel buildings"

SAYS MR. CHARLES W. JACKSON, *President of Quonco, Inc., fabricated steel building sales and erection firm of Indianapolis, Ind.*

Experience has taught Quonco, Inc., that it takes more than conventional material to properly insulate a fabricated steel building. First of all, the material must be self-supporting and preferably blanket-type. It must be lightweight and very easy to handle. Further, it must be extremely efficient in insulating against heat loss and absorbing noise.

Quonco found all of these insulation advantages in one product—Pittsburgh Superfine Fiber Glass. Mr. Jackson, President of the Indianapolis firm, sums up the advantages this way: "Since Pittsburgh Superfine in our buildings reduces heat loss to only ⅓ that of conventional masonry buildings, our customers can plan for a lower initial investment in heating equipment, and cut their estimated fuel costs considerably." As an example, Mr. Jackson cites the case of the world's largest fabricated steel building—7½ acres—in which 300,000 sq. ft. of Pittsburgh Superfine was used. Only one of the plant's three boilers, and 7 of the plant's 12 air supply units is needed to maintain a comfortable 75° for over 3000 employees. Even during hot summer months, temperatures are 10° to 15° cooler inside without air conditioning.

If plant and office modernization or construction is part of your current plans, be sure to know about the unusual features and savings that Pittsburgh Superfine insulation can provide you. For your copy of Bulletins F-100 and F-130, write Fiber Glass Division, Pittsburgh Plate Glass Company, One Gateway Center, Pittsburgh 22, Pa. For immediate service on your specific problem, you can call the nearest Fiber Glass Division sales office listed below.

PITTSBURGH SUPERFINE FIBER GLASS IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, and St. Louis

FIBER PG GLASS PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

THE NEW UNARCO DYNA-PAC

...FEATURING BOTH ECONOMY AND EFFICIENT LONG LIFE

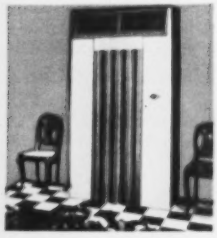
- **2-, 3-, 5-ton capacities in water-cooled or air-cooled models**
- **For residential and commercial installations**
- **Selective manual humidity control**
- **Built-in plenum**
- **4-way adjustable top air discharge on free blow models**

The all-new UNARCO Dyna-Pac meets the challenge of better air conditioning at lower cost. What's more, it was designed with the installing contractor in mind. All Dyna-Pac units are pre-wired and pre-piped for easy, low-cost installation.

There is economy in both the low initial cost and minimum maintenance required. There is also economy of space with the compactly designed DYNA-PAC. Duct models can be attached to existing warm air heating systems to provide year 'round conditioning.

Write Dept. HC-105-C for full information, including catalog and prices.

UNION ASBESTOS & RUBBER COMPANY
332 South Michigan Avenue, Chicago 4, Illinois

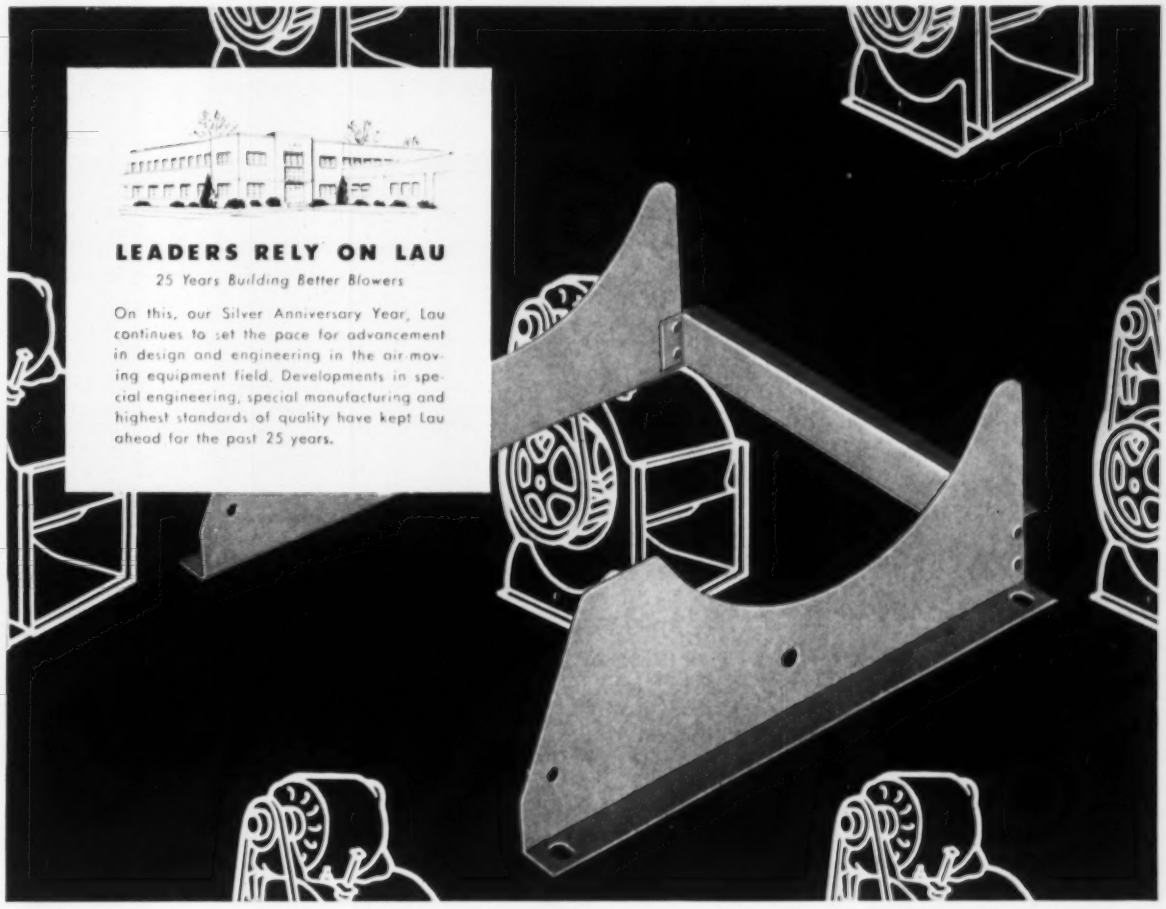


The Royal-Aire—by UNARCO—representing the ultimate in packaged air conditioning equipment. Available in 5 models, 3 through 15 h.p.

UNARCO

PACKAGED AIR CONDITIONERS

HAVE YOU ENROLLED IN UNARCO'S DEALER PLU$ PLAN? WRITE NOW FOR FULL DETAILS OF BIG DEALER AWARD PROGRAM.



LEADERS RELY ON LAU

25 Years Building Better Blowers

On this, our Silver Anniversary Year, Lau continues to set the pace for advancement in design and engineering in the air-moving equipment field. Developments in special engineering, special manufacturing and highest standards of quality have kept Lau ahead for the past 25 years.

MASS HOUSING SUPPORT

THE LAU BLOWER COMPANY

2000 Home Ave. • DAYTON 7, OHIO

Other plants at Kitchener, Ont., Canada, and Azusa, California

This exclusive Lau-designed housing support has set the pattern for the blower industry. It has extreme structural rigidity, of heavy 8 to 12 gauge steel (depending on blower size), is cross-braced where required, and supports the entire blower assembly with strength in every part. You'll find our housing support applicable to *all* angles of discharge (standard and special), without adjustments or changes. There is no impedence to air flow. Provision has been made for rubber mounting grommets where needed. Get next to Lau for blowers and blower parts to meet your specific requirements. Write today for name of salesman in your area.

LB-6, 56

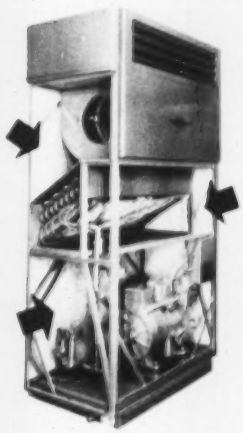
SERIES "A" BLOWER · ELECTRO-WHEEL BLOWER · LAU-PAK BEARING · SERIES "A" WHEEL · WELD WHEEL · LAUSTEEL PULLEY · BEARING BRACKET · PANEL FAN · RANCHER FAN

WORLD'S LARGEST MANUFACTURERS OF AIR-CONDITIONING BLOWERS

INSULATION news from L·O·F GLASS FIBERS COMPANY

Clean, resilient Microlite is pleasant to handle—speeds application—saves on cost of labor.

American Coils Co. relies on Microlite to insulate all their air conditioners



The American Coils Co., Newark, N. J., finds Microlite has the high thermal insulating efficiency needed in top-quality ACI Air Conditioners, Comfortaire Heat Pumps, and ACI Packaged Chillers.

Engineers state that past experience proves Microlite is especially effective in reducing fan, motor, and compressor noise!

Microlite's high thermal and acoustical efficiencies are due to the countless dead air cells formed by minute glass fibers! These long, fine glass fibers give Microlite its high tensile strength and resiliency . . . make it pleasant to handle, without danger of tearing.

Lightweight Microlite gives you these other advantages, too . . .

- Resists settling!
- Won't absorb moisture or rot!
- Glass fibers do not support combustion!
- Compressed rolls save storage space—insulation springs back to full thickness when unrolled!

For full details, write L·O·F Glass Fibers Company, Dept. 39-66, 1810 Madison Avenue, Toledo 1, Ohio.

L·O·F GLASS FIBERS MICROLITE INSULATION

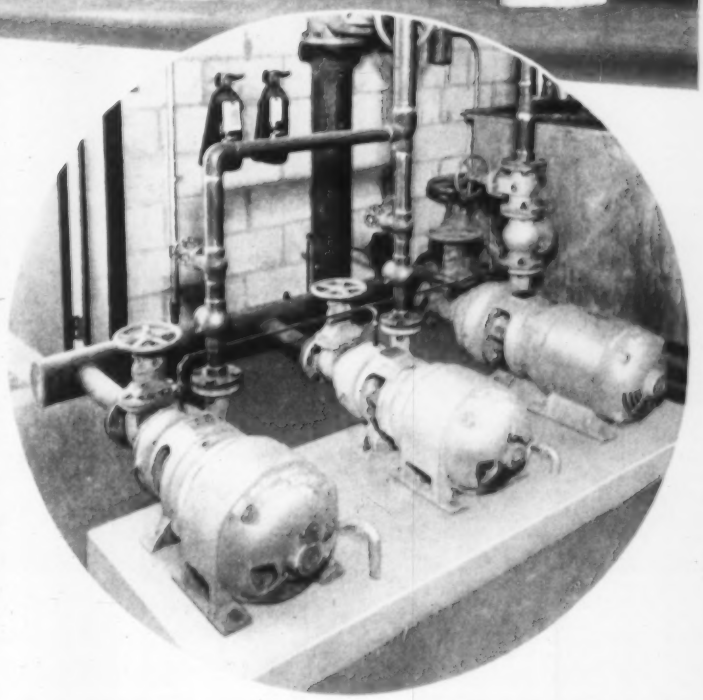
L·O·F GLASS FIBERS COMPANY

TOLEDO 1, OHIO

Makers of glass fibers by the exclusive "Electronic Extrusion" process

another new supermarket PENN FRUIT another MOTOR PUMP installation...

Dependable and economical Ingersoll-Rand Motorpumps help assure operation of the New Supermarket's 100 ton air conditioning system.



Air conditioning architects, engineers and contractors who know the importance of customer satisfaction, are depending more and more on Ingersoll-Rand Motorpumps for care-free, trouble-free service.

Advanced features and rugged construction of I-R Motorpumps for air conditioning have meant an end to costly breakdowns. Low-cost operation and ease of installation make them the natural choice for air conditioning systems.

For additional information contact your nearby Ingersoll-Rand representative or write for data to Ingersoll-Rand Cameron Pump Div., 11 Broadway, New York 4, N. Y.

Features like these set the pace with years-ahead performance:

- Compact, space-saving
- Operate in any position
- Simple installation
- Sizes up to 75 hp

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Let Novelty's combination of 50 years of fabricating vessels and the most advanced lining facilities be your assurance of selecting and building an enduring vessel. Write, telegraph or telephone your problem — today!

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UNFIRED PRESSURE VESSELS

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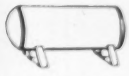

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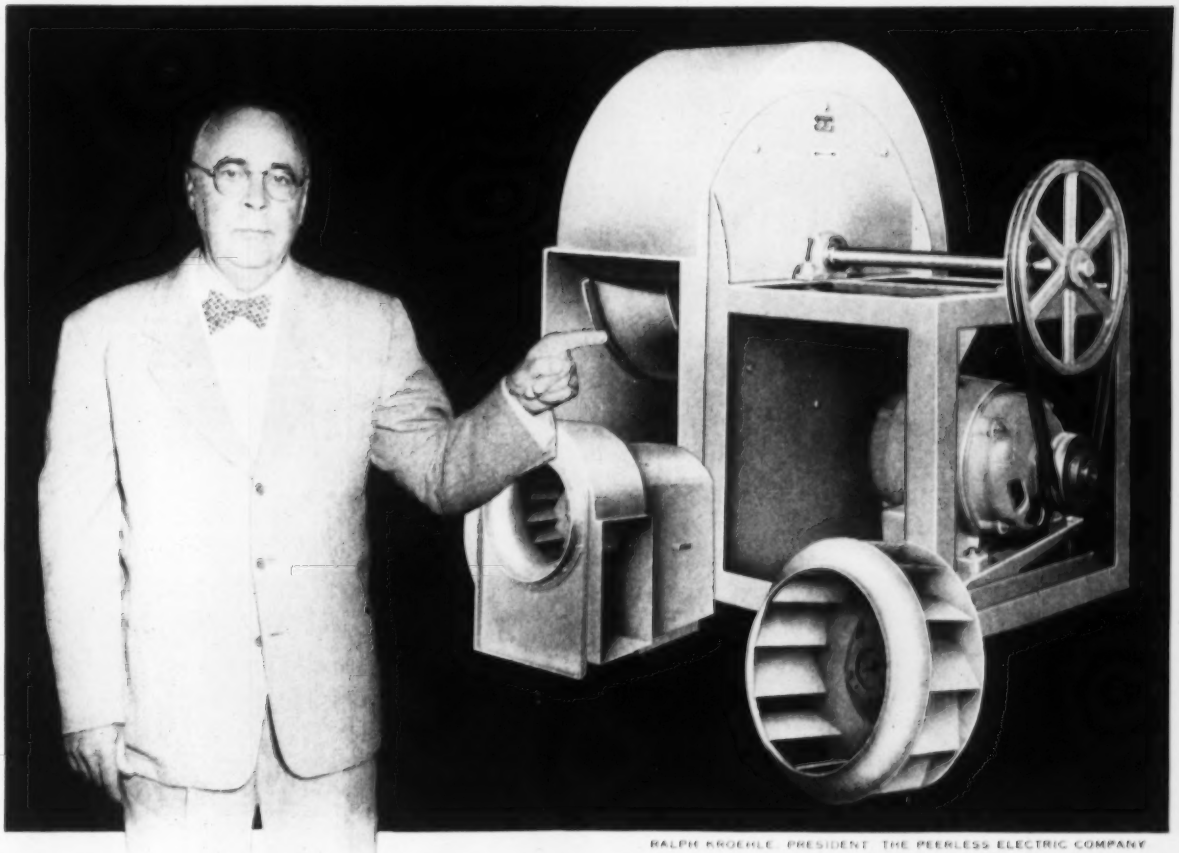

RALPH KROEHLE, PRESIDENT, THE PEERLESS ELECTRIC COMPANY

"...THE BEST BLOWER ENGINEERING..."

● Peerless engineers work under orders to give every fan and blower "the best possible engineering." Our engineering standards now meet or exceed all industry codes. The reason is simple.

COMPLETE ENGINEERING—Peerless builds its own motors and job matches them to meet blower requirements. They have the advantage of being one complete unit, tested thoroughly for motor characteristics, speed and drive alignment.

HEAVY CONSTRUCTION—Peerless frames and housings are better and of heavier construction than any competitive products. Construction is all-welded. The result is a vibration-free unit.

NAFM APPROVED—Peerless Backward Curve Belt Drive Utility Blowers in sizes from 12½" to 36½" meet all NAFM recommendations. They have self-limiting horsepower characteristics and dynamically balanced wheels with matched-spun cones. There is nothing in the air stream. Operation is exceptionally quiet.

CERTIFIED RATINGS
AUTHORIZED BY NAFM

PERFORMANCE DATA—Complete data on Peerless fans and blowers is cataloged for easy reference. Bulletin SDA-160 shows all fans and forward curve blowers. Bulletin SDA-200 gives all data on backward curve blowers (NAFM) from 12½" to 36½". Use the coupon below to get your file copy. Dimension prints are available on request.

THE PEERLESS ELECTRIC CO.
WARREN, OHIO

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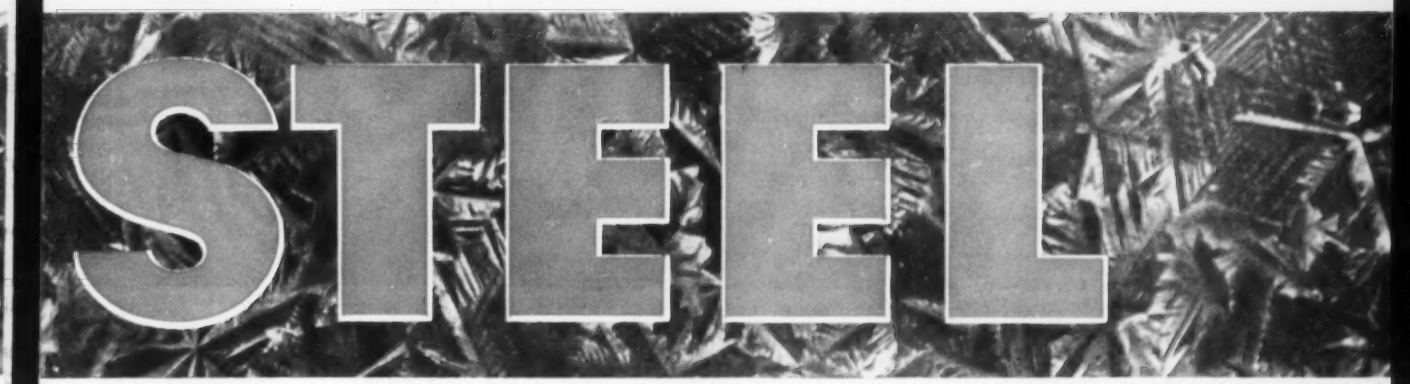
You can count on

JL GALVANIZED SHEETS

to safeguard the quality of your work

for galvanized sheets



Now sheet metal users can look to a new, dependable source of galvanized sheets. Jones & Laughlin Steel Corporation is putting more than 100 years of steelmaking experience behind its new facilities for the production of high grade galvanized sheets.

New J&L Galvanized Sheets carry on the J&L reputation for quality steel. Produced with uniform ductility, flatness, and surface finish, they are typical of J&L ability to produce to exacting specifications accurately and faithfully.

Galvanized by the proven Sendzimir process, J&L Galvanized Sheets have a tight uniform coating that resists cracking and flaking, even during severe forming and drawing operations.

J&L Galvanized Sheets are produced with a high-lustre finish that creates eye appeal and customer acceptance for your finished products.

The next time you order, remember—J&L Galvanized Sheets are available in both coils and cut lengths to fit your continuous operations. They work up easily—can be formed, rolled, drawn and cut to your satisfaction.

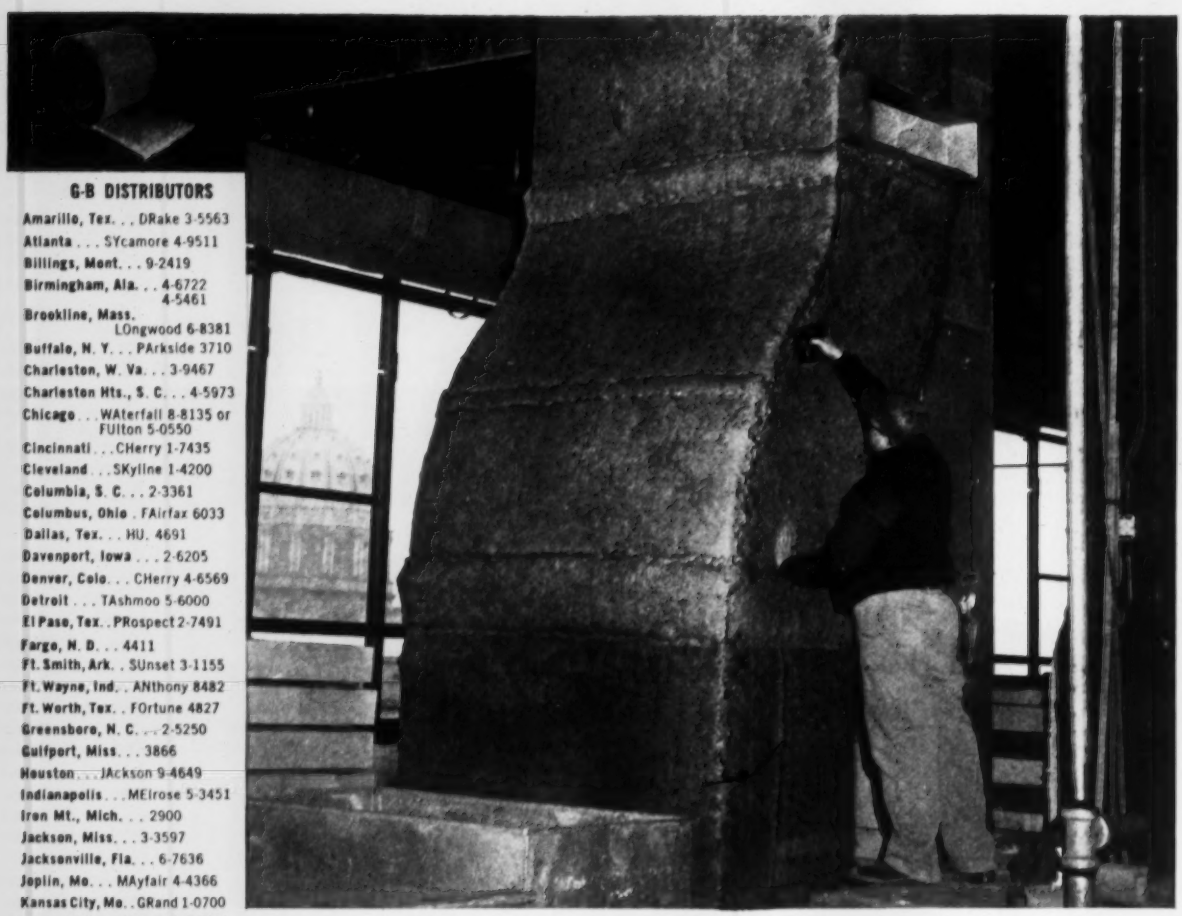
Available in a range of gages and widths to meet your requirements. Get complete details today.

J&L

STEEL

Jones & Laughlin

STEEL CORPORATION, PITTSBURGH



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GUSTIN gb BACON

Low heat loss is "Capitol gain"... thanks to ULTRALITE

On "Capitol Hill" in Harrisburg stands the new Pennsylvania State Office Building* — a modern monument to streamlined government.

Throughout this 11-story structure, 60,000 sq. ft. of combination heating-cooling ducts are insulated with ULTRALITE, the only insulation of long glass fibers. In such a vast system, the control of temperature is extremely important — and vibration can also be a potential problem. That's where ULTRALITE comes in. Its superior thermal efficiency will hold heat loss and heat gain to a minimum and this rugged, resilient insulation will dampen vibration indefinitely without insulation damage or loss of thickness.

But performance is only part of the ULTRALITE story. Its many unique physical properties and handling characteristics make it the *most economical duct insulation* you can apply. And ULTRALITE is more readily available than any other glass fiber insulation — as you can see by the adjoining column that lists your nearby distributor.

*Architects: Lacy, Atherton and Davis. Gen. Contractor: Ritter Brothers. Insulation Contractor: Triangle Insulation Co., Philadelphia.

WRITE TODAY FOR NEW BROCHURE ON "ULTRALITE DUCT INSULATION AND DUCT LINER"

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Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Molded glass fiber pipe insulation

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FROM *Chicago*

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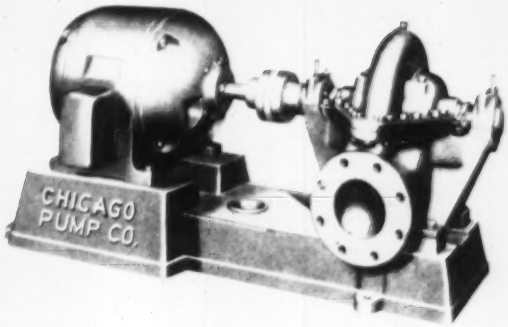
Engineered for plumbing, heating, and air conditioning systems

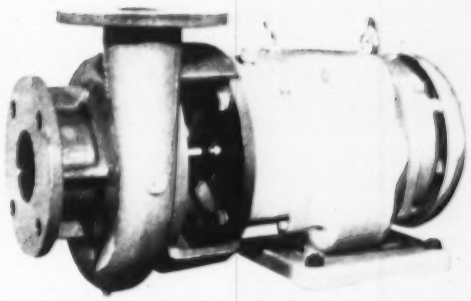


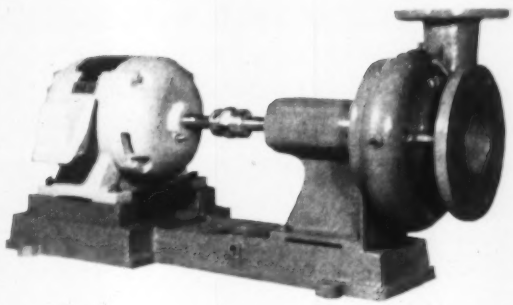
TYPE D DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP

A rugged, heavy-duty pump that guarantees long, trouble-free service. The rotating assembly may be inspected without disconnecting the piping. Capacities up to 1900 G.P.M. Heads to 530 Ft. Described in Bulletin 101.

TYPE CC CLOSE COUPLED PUMP

Handles the toughest pumping jobs efficiently and in the least possible space. May be mounted in any position as long as the motor is not lower than the pump. Equipped with leak-proof mechanical seal. Capacities up to 500 G.P.M. Heads to 215 Ft. Described in Bulletin 103.





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Like the CC, all FC pumps are equipped with the most reliable mechanical seal ever built into a pump. Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. Described in Bulletin 107.

For trouble-free, "worry-proof," efficient pumping at all times — specify Chicago Pumps. Write for complete information.

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Subsidiary of Food Machinery and Chemical Corporation

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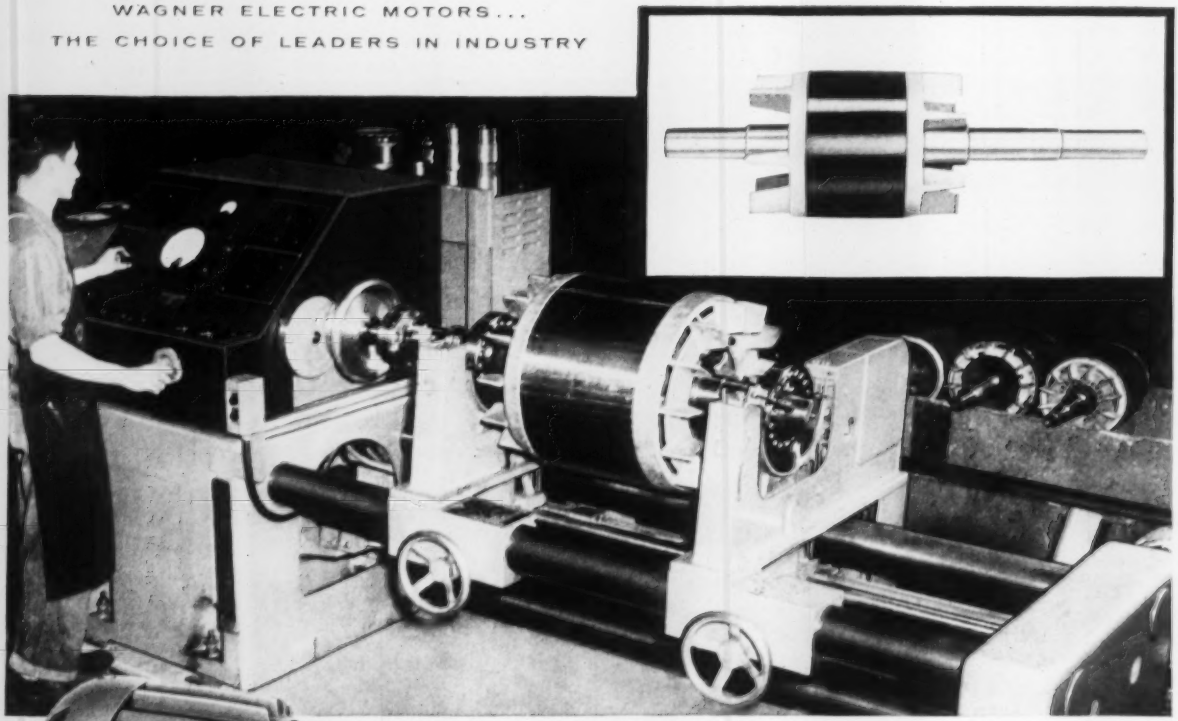
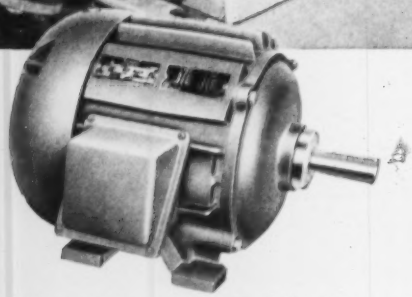
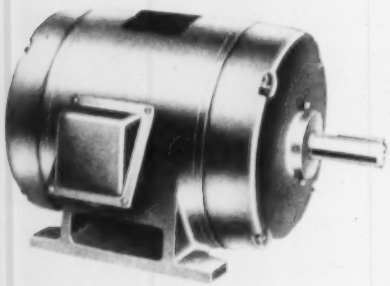
Condo-Vac ® Sure Return ® AVC LVC Fire House & Circulating Pumps. Pneumatic & Tankless Water Systems. Flush Rinse & Sewage Ejectors. Little Giant ® & Non-Clog Bilge Pumps. Pumps for every industrial use.

WAGNER ELECTRIC MOTORS...
THE CHOICE OF LEADERS IN INDUSTRY





Wagner totally-enclosed fan-cooled motor, 1 through 30 hp, NEMA Frames 182-326U.



Wagner open type drip-proof motor, 1 through 30 hp, NEMA Frames 182-326U.

All Wagner Motors are *DYNAMICALLY BALANCED* for smooth performance

Motor balance is important to fine machine and equipment performance. A well-balanced motor greatly reduces vibration—allows your equipment to operate smoothly and quietly.

Every rotor, even in the smallest fractional hp rating, used in a Wagner Motor is dynamically balanced on balancing machines like that shown above.

Your selection of Wagner Motors for your applications gives you other benefits, too. You can specify totally-enclosed motors that are fully protected against damage from filings, chips, dirt, fumes, moisture; or open type drip-proof motors—in ratings through 500 hp. Wagner Motors are *known* for dependable performance . . . they assure freedom from costly motor maintenance and even more costly motor failure. And you have motors that can get on-the-spot service when needed—anywhere in the United States.

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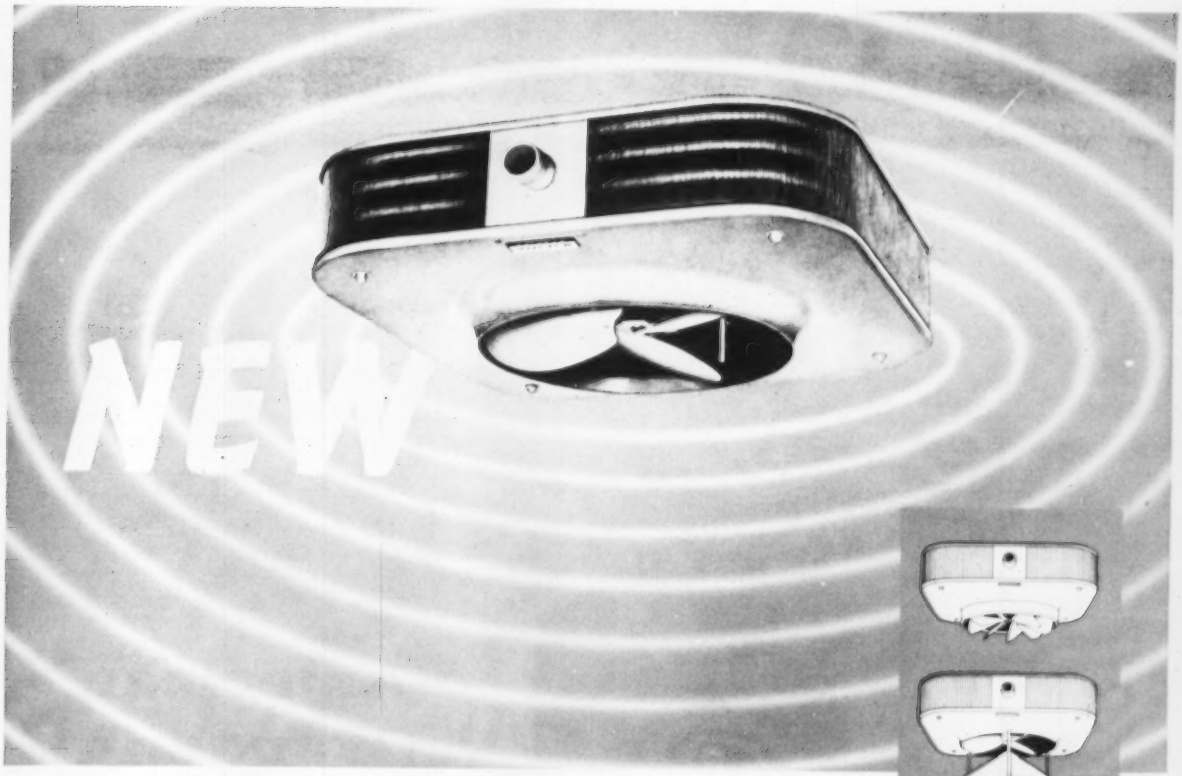

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Now choose from 34 *completely new* Webster Little Giant Unit Heaters, all *usable interchangeably* with either steam or hot water. Here's a partial list of the new design features:

- Rectangular wrap-around heating elements for use interchangeably with steam or hot water
- Wide choice of air-deflector attachments (see pictures at right)
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- Vibration-free air flow
- Horizontal discharge units, too
- IUHA-rated for capacity and sound

Call your Webster Representative for the new 20-page Bulletin B-1730. Or write us. Address Dept. HP-6

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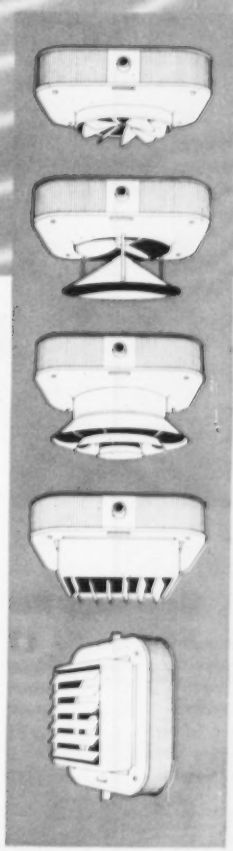
Camden, New Jersey



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HEATING AND COOLING
EQUIPMENT

American Cyanamid burns coal the modern way, saves $100,000 a year

Increased production demanded additional steam in American Cyanamid's plant at Bridgeville, Pa. Management decided to analyze its power system with an eye to improving operating economy and efficiency.

The decision was *modernization,* with emphasis on more efficient distribution of steam, generated by burning pulverized coal. New steam traps were installed, waste steam was utilized, condensate was recovered, piping was simplified, a thorough system of maintenance and repair was instituted. The sound thinking behind this unusual program—unusual in that power system economies took place *after* steam generation—today rewards American Cyanamid with a savings of $100,000 a year!

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building • Washington 5, D. C.

Consult an engineering firm

Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities—or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

WILL-BURT STOKERS

IN GASTON COUNTY SCHOOLS

GASTONIA, NORTH CAROLINA

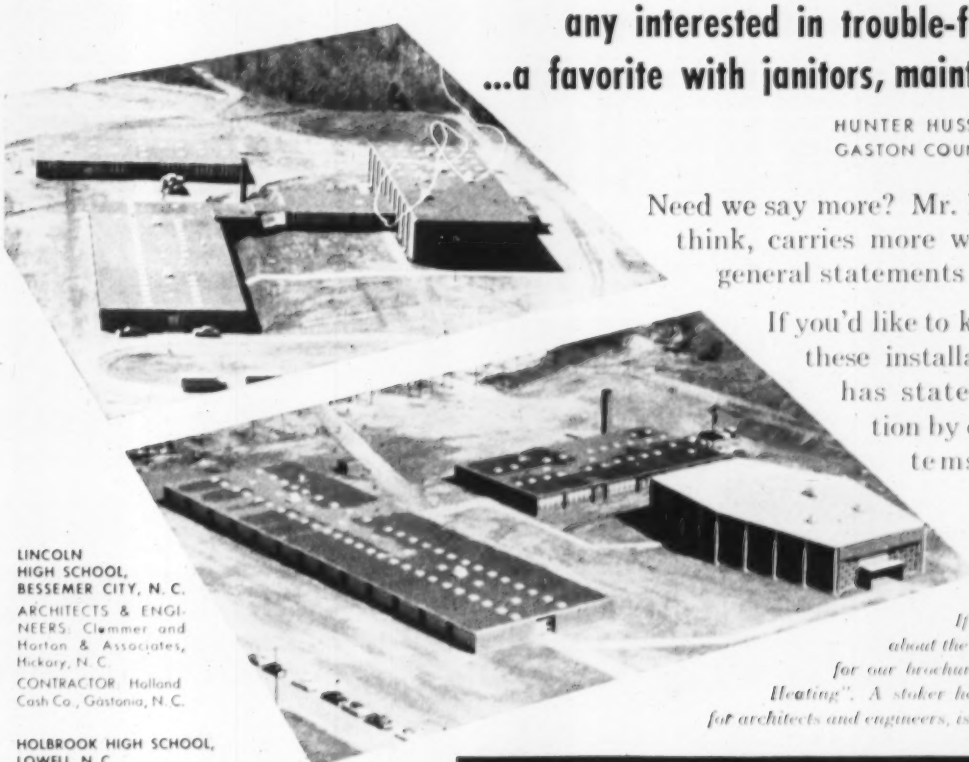
NEW HOPE ELEMENTARY SCHOOL, GASTONIA, N. C.
ARCHITECT: Frank B. Griffin, Gastonia, N. C.
ENGINEER: W. P. Wells, Charlotte, N. C.
CONTRACTOR: Gastonia Plumbing & Heating Co, Gastonia, N.C.

"...extremely proud of our 72 Will-Burt Stokers...recommend to any interested in trouble-free operation ...a favorite with janitors, maintenance men"

HUNTER HUSS, SUPERINTENDENT
GASTON COUNTY PUBLIC SCHOOLS

Need we say more? Mr. Huss' praise, we think, carries more weight than any general statements we could make.

If you'd like to know more about these installations, Mr. Huss has stated that inspection by other school systems is welcomed.



LINCOLN HIGH SCHOOL, BESSEMER CITY, N. C.
ARCHITECTS & ENGINEERS: Clemmer and Horton & Associates, Hickory, N. C.
CONTRACTOR: Holland Cash Co., Gastonia, N. C.

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Distributor for above installations: Atlas Supply Co., Charlotte, North Carolina

If you'd like to know more about the Will Burt Stoker, write for our brochure, "The Logic of Stoker Heating". A stoker heating manual, written for architects and engineers, is also available.

The WILL-BURT Company

OUR TWENTY-SEVENTH YEAR IN THE STOKER BUSINESS

P.O. BOX 902, ORRVILLE, OHIO

Office Building

THE NEW ENGLAND LIFE BUILDING, Boston, Massachusetts. Architects: Cram & Ferguson; Engineers: Buerkel & Company. ELECTRO-MATIC filters supply 200,000 cfm of super-clean air on nine air conditioning systems.

Saves $16,000 a Year

with *Electro*·MATIC filters!

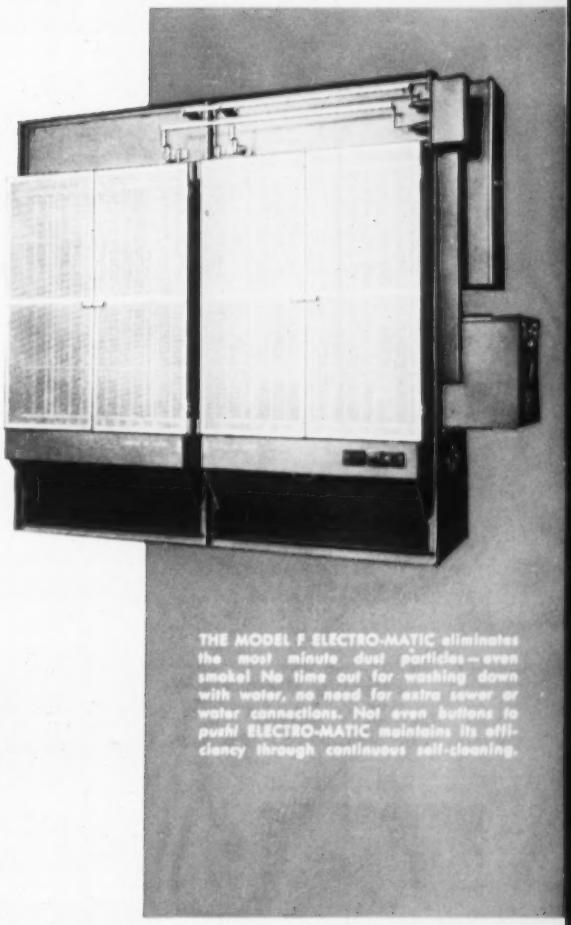
New England Life Building gets SUPER-CLEAN Air at a saving

IN 1941, when the New England Life Insurance Company moved into its beautiful new building, *mechanical* filters were installed to supply 200,000 cfm of clean air for nine air conditioning systems.

Six years later, these filters were replaced with AAF ELECTRO-MATICS. Results: *super-clean* air allowed a *20% reduction* in the cleaning staff. The ELECTRO-MATICS have long since paid for themselves and are now saving the Company $16,000 *every year* they are in operation!

And maintenance is remarkably simple. One man spends *less than 8 hours a week* maintaining filters on all nine systems. That's because ELECTRO-MATIC has its own built-in "maintenance crew"—cleans *itself* continually, *while it's cleaning the air!*

Super-clean air at a saving—that's "the New England Life ELECTRO-MATIC Story" in a nutshell. *Now*—get the *whole* story. Write for free 12-page booklet that provides complete data on ELECTRO-MATIC's money-saving performance.



THE MODEL F ELECTRO-MATIC eliminates the most minute dust particles—even smoke! No time out for washing down with water, no need for extra sewer or water connections. Not even buttons to push! ELECTRO-MATIC maintains its efficiency through continuous self-cleaning.

AAF American Air Filter COMPANY, INC.
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375 Central Avenue, Louisville 8, Kentucky
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AAF Dust Control Equipment

Illinois Steam Heating Specialties

BETTER AIR IS OUR BUSINESS

Herman Nelson Unit Heaters

Herman Nelson Unit Ventilators

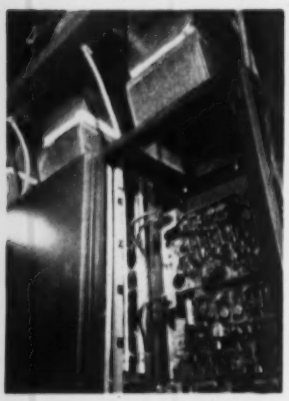
Gallaher Air Vans® Provide QUIET Efficient Ventilation for this TV Station

WXIX, Milwaukee represents a $1,500,000 investment by the CBS television network

Lotte and Fredericksen, Engineers

One place where a quiet operating exhaust system is a *must* is in the atmosphere of a TV Station. And at WXIX, the Columbia Broadcasting System outlet in Milwaukee, Gallaher Air Vans were specified for this vital job.

Air Vans are teamed with the station's air-conditioning system to keep hundreds of electronic tubes from melting in their self-created heat. Air Vans are used for the tasks of ventilating toilet rooms, equipment rooms and studios. Quiet operation and accurate performance were the reasons given by the engineering firm of Loft and Fredricksen for specifying Gallaher Air Vans.



Without an efficient power ventilating system these banks of tubes would melt.

Gallaher research makes this quiet efficient operation possible because Air Vans have been manufactured with special vibration isolators that keep noise levels low. Air Vans are *designed* with streamlined inlets that drastically reduces turbulence—a major source of noise. Efficient performance, developing up to 4 inches of static pressure, is the result of Gallaher's exclusive patented Scroll Design.

The WXIX installation is one more example of why more and more architects and engineers are switching to Air Vans.

It pays because when you buy Gallaher Air Vans you get the vital features that are the secret to years of service and performance. Air-Vans are available in capacities from 150 to 65,000 CFM.

Write for full information to:

The GALLAHER Company

4108 Dodge Street Omaha, Nebraska

Export Office: 306 Paul Bldg., Utica, N. Y. Cable: Keiserquip

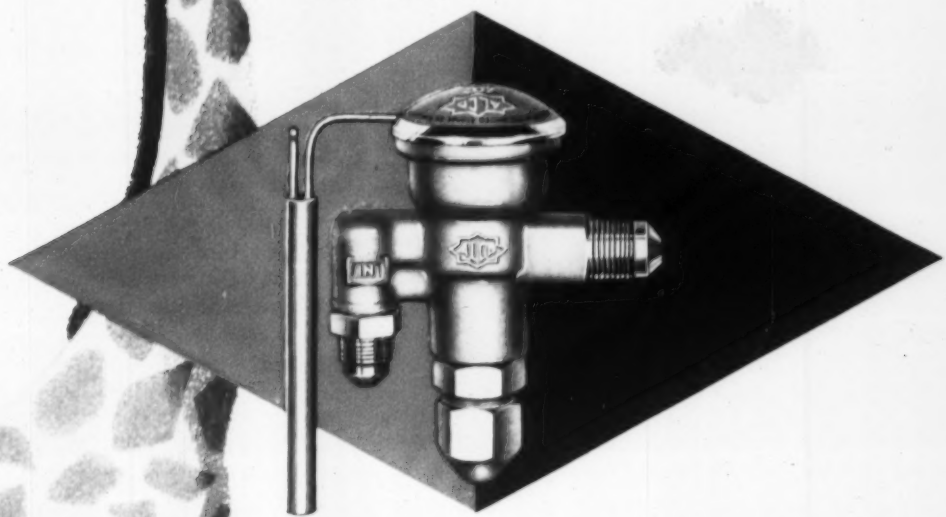
for hard-to-reach spots

ALCO 402

the small-fixture Thermo Valve

Prevents motor overload.

May be installed in any position—
even upside down—
in or out of the refrigerated area.
It's liquid charged.



choose from these convenient sizes:

Freon 12—¼, ½ and 1 ton
Freon 22—.4, .8 and 1.6 tons
Methyl-Chloride—½, 1 and 2 tons

ALCO 402
WITH THE NEW
EASIER-TO-INSTALL BODY
ENGINEERED FOR SERVICE ENGINEERS

SEE YOUR ALCO WHOLESALER

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

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7025

FOR SUMMER COMFORT,

the U. S. National Bureau of Standards rates multiple layers of aluminum FIRST

among all insulations it tested, as reported in its booklet,

"Effect of Ceiling Insulation upon Summer Comfort," BMS52.

(You can get it at our expense.)

To be comfortable in summer you must ward off unwanted heat rays or radiation. Most heat flow thru a *roof space* in summer is by radiation. There is no convection down, and little conduction thru low density air.

Temperatures can reach over 140° F. in some attics. With an absorptivity for heat rays of only 3%, reflectivity 97%, and emissivity 3%, scientific multiple aluminum is an effective shield against summer heat. The slight mass of its components, air being preponderant, makes it very low in heat storage.

COST OF AIR-CONDITIONING REDUCED

This shield against radiant heat lifts part of the load from house-cooling equipment, reducing installation and up-keep costs. But the building which is *not* artificially cooled, needs this shield even more!

Multiple aluminum is also markedly effective against radiation through a *wall space.*

Air of higher outside temperatures will support more vapor than the cooler air inside a building. Often vapor flows from the outside to the inside of the house, obedient to the law of physics that vapor travels from areas of greater density to areas of less vapor density.

Multiple aluminum has long, continuous metallic sheets on *both* sides which are almost impervious to water vapor. Infiltration under the flat, stapled flanges is slight. The scientific construction of multiple layers of aluminum, fiber and air spaces, minimizes condensation formation on or within this type of insulation. Timber rot, crumbling plaster, peeling paint, etc. are minimized.

CAUTION: *We do not recommend placing vapor barriers on both sides of all insulations.*

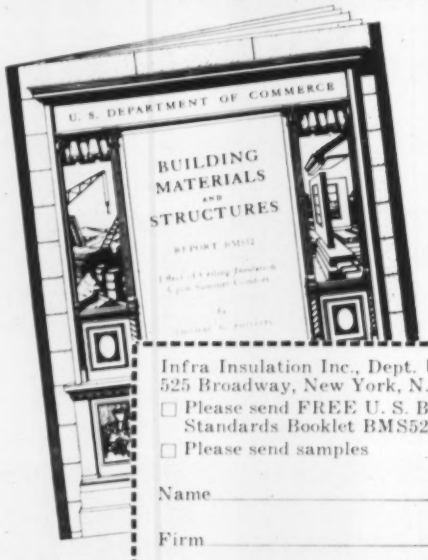
IN WINTER, NEED FOR INFRA EVEN GREATER

The low conductivity, the slight heat ray absorptivity and emissivity of scientific multiple aluminum, and the retarding of inner and outer convection by the multiple layers of metal and fiber, amazingly effective in summer, assume paramount importance in winter when this 3-fold bar to outward heat flow cuts fuel bills and increases comfort.

To obtain MAXIMUM, **uniform-depth** protection against heat loss and condensation formation, it is necessary to use the new **edge-to-edge** multiple aluminum*, **each** sheet of which stretches from joist to joist.

*Patent applied for

INFRA INSULATIONS CAN BE PURCHASED everywhere through your preferred local dealer for 3¢ to 12¢ per sq. ft. depending on the type.



Infra Insulation Inc., Dept. H-6.
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HPAC Contractors Convene in Louisville

. . . elect new officers

THE Heating, Piping, and Air Conditioning Contractors National Association held its 67th annual convention at the Brown hotel in Louisville, Ky., last month.

George Hall, of Madison, Wis., was elected president of the association, succeeding Edward Jungbert, of Louisville. The new vice president is Joseph H. Spitzley, of Detroit, Mich. Horace E. Wetzell, of Cleveland, Ohio, is now treasurer.

P. B. Gordon, of New York City, was presented the association's distinguished service award in recognition of his "outstanding service to the industry and for his many years of loyal service to the association." The award was presented by Wray M. Scott, a past national president and recipient of the award in 1955.

Secretary Lloyd B. Gruman announced that the national headquarters of the association is to be moved from New York City to Washington, D. C.

As a result of presenting the name change of the association before last year's convention, the new name of The Mechanical Contractors Association of America was formally adopted at this meeting. The action is not intended to change the scope or activities of the association.

Complete reports of what took place at the convention will be published in the July HPAC.

The convention was saddened by the tragic death of six Crane Co. executives and the two pilots in the crash of their plane in which they were travelling to the meeting. A resolution was adopted by the association recognizing the contributions of these men toward the progress of the industry and the great loss that will be felt in their passing.

The victims were:

George L. Erwin, Jr., vice president, heating sales division.

James A. Dwyer, vice president, industrial sales division.

J. A. McMurry, director of branches.

Charles E. Towner, assistant to the vice president, heating sales division.

George G. Lindholm, manager, valve and fitting department.

Fred J. Wilkey, special representative, industrial sales division.

Randy Mulherin, pilot.

Robert Robinette, copilot. ⊣

Air Conditioning Cost Averages $5 Per Sq Ft

. . . in existing buildings

REMODELING a prime building for air conditioning costs approximately $5 per sq ft, including plaster patching and decorating, according to William S. Everett, vice president of Browne and Storch, Inc., in a recent address before the Chicago Real Estate Board's renting and management division reported in Skyscraper Management.

The Field building, said Mr. Everett, is paying over $6 per sq ft. "This is about $0.25 per cu ft, compared with an estimated $0.15 per cu ft added to the cost of new buildings."

At $5 per sq ft, "you can see that a sizable investment is required for a building of 500,000 to 1 million sq ft," he said. "But it is apparent that many older buildings must make the investment or be downgraded both as to rent and popularity. If top prices are to be obtained, then top service must be offered. No space is Grade A today unless it is air conditioned."

He predicted that 1956 will see a number of buildings, held by marginal investors, estates, and institutions who do not choose to make the investment, offered for sale. ⊣

Better Fuel Combustion Abating Air Pollution

. . . expert tells symposium

MORE first practical steps for the elimination of air pollution have been inaugurated by both small and metropolitan cities during the past two years than ever before, a veteran fuels engineer and smoke abatement authority, Ernest E. Finn, told the recent annual Symposium on Air Pollution and Its Control at Wagner College, Staten Island, N. Y., according to the Anthracite Information Bureau.

Mr. Finn, a member of the Philadelphia Air Pollution Control Board, pointed out that metropolitan centers like Providence, R. I., and smaller cities like Elmira and Poughkeepsie, N. Y., are eliminating the chief causes of smoke and soot in their atmospheres resulting from faulty fuels combustion.

Mr. Finn termed new regulations put into effect by the Philadelphia Air Pollution Control Board, "a most constructive step and example for other cities." These involve additional controls and smoke alarms for all heating installations using residual oil and bituminous coal, and they specify that furnaces and boilers use only the fuel for which they were originally intended.

Also at the Symposium, Norman C. Curtin, consulting engineer of the Anthracite Information Bureau, outlined examples of modern installations of smokeless anthracite and mixtures of high volatile fuels and anthracite, along with recent developments in commercial hard coal space heating equipment, that "ease the way for effective smoke control activity." He said the development of the commercial coal stoker from the round retort to the cross feed principle has also eliminated the possibility of fly ash emission at high

burning rates in buildings using the fuel for heating. ‡

Apprentice Contest Coming August 6-10

. . . for plumbing and pipe fitting

THE THIRD ANNUAL international apprentice contest for plumbing and pipe fitting will be held at Purdue university, Lafayette, Ind., August 6 to 10, according to the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U.S. and Canada.

The international tests, like the state or provincial tests, will each consist of two parts, a written and performance test.

The written test will constitute 50 percent of the total grade in the contest. It will be made up of questions of various types, sketches, etc., in accordance with the relative importance of the subject matter. The objectives will be: (1) to test what has been learned or should be learned from work experience or training received on the job as well as from the related training program; and (2) to test knowledge of the related technical information and the application of this information to work on the job. The questions are designed to facilitate accurate grading by the judges with fairness to all participants.

The performance test will constitute 50 percent of the total grade in the contest. It will include, among other things, projects to be performed from typical drawings or sketches, and the approximate time for each project will be specified. The objectives of the performance test will be: (1) to test practical skills in performance of typical jobs or operations; and (2) to test ability to work from typical drawings or sketches.

Sponsoring the contest with the United Association are the Heating, Piping and Air Conditioning Contractors National Association, the National Association of Plumbing Contractors, and the National Association of Master Plumbers and Heating Contractors of Canada. ‡

Heating and Ventilating Cost for N.Y.C. Buildings

. . . rose 5 percent last year

HEATING AND VENTILATING services in the public buildings operated by the New York city department of public works cost 5 percent more in the 12 months ending June 30, 1955, than the year before, according to the annual report of Frederick H. Zurmuhlen, commissioner, issued recently. From $0.157 per sq ft in 1954, the cost for these services went up to $0.165 per sq ft.

The operation and maintenance of the municipal office buildings, borough halls, and courthouses under the department's jurisdiction is the main function of the division of building management.

In 1955 the division operated a total of 60 buildings, one less than the year before. However, total gross area increased from 7,359,454 sq ft to 7,477,100 sq ft, as a result of some building transfers. The oldest of these buildings is City Hall, which was completed in 1812. Five other buildings are more than 100 years old; 22 are more than 50.

Buildings included in the report are occupied by 30 city departments, courts, and commissions. Not included are hospitals, health centers, libraries, markets, prisons, fire houses, garages, and other buildings not under the department of public works.

Constantly sought are new equipment and materials which will do a better job and reduce labor costs, according to the director of the division of building management, Walter J. Detmar.

Maintenance of 225 window air conditioners owned by the city and installed in various executive offices for which the division is responsible is done under contract for about $15,000 per year and is supervised by the bureau of building maintenance.

Maintenance and operation of heating plants and ventilating and air conditioning equipment is the responsibility of the bureau of mechanical maintenance and operation, under the same division. Engineers and mechanics watch for any operating defects and try to repair or replace equipment immediately without interrupting service or inconveniencing tenants or the public.

A crew of pipe fitters with one emergency truck handles emergency and miscellaneous repairs to boilers and heating systems. Two maintenance men are on call day and night for repairs to smaller oil burners.

Specifications and drawings are prepared for alterations and additions to the mechanical equipment.

Contracts are let for boiler water treatment as well as for air conditioning equipment.

To heat these buildings required 2½ million gal of fuel oil, 1500 tons of coal, and 300 million lb of purchased steam last year.

Staff for the operation and maintenance of the buildings totals 1819 persons. ‡

"Quote"

"From the time of birth to death, the most important thing in the world to every human creature is air." — *Dr. O. L. Barnebey, president, Barnebey-Cheney Co., before the American Society of Refrigerating Engineers, Southern California Chapter.*

How electronics makes P-K exchangers better than ever

This man is expanding tube ends into the tube sheet—the "inner face" of a shell and tube heat exchanger that holds each tube in place. By doing it electronically, with the equipment you see here, the circumference of each tube is joined to the face of the exchanger with exactly the same pressure.

This minimizes the possibility of leaks developing—even when a mile of tubing and hundreds of tube ends are involved, as they are in many of P-K's special exchangers.

But fabricating procedures like these are only part of the story. Every P-K unit is "computed" for its thermal rating and design.

This automatic check of a unit's thermal rating is not only a safeguard, but can often save you money. And it allows P-K to give a full and complete guarantee that each unit will perform at its rated heating or cooling capacity.

An increasing number of processors, engineers, and contractors have come to rely on P-K's painstaking fabrication and testing procedures —and their check, and double-check, of a unit's thermal rating. We would be pleased to design and build exchangers for you.

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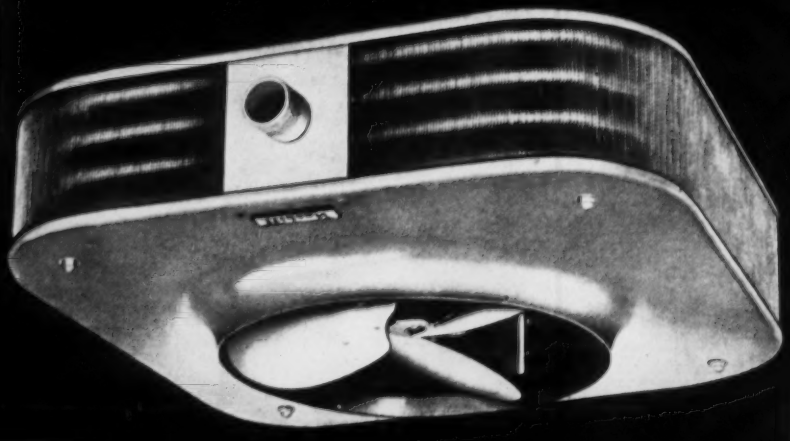

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One heating element operates on steam or hot water in both vertical and horizontal applications. Wrap-around rectangular construction increases heat transfer area. Opposing headers mean shorter tubes and condensate travel, assuring more even heating on steam systems.

Closer-to-ceiling mounting permitted by side-located piping connections. Motor on all models is removable through bottom fan outlet, eliminating the need for access space above the unit. Maximum headroom is assured.

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Larger capacity range (34,000 to 684,000 Btu per hour) and smaller physical size permit the economical use of these "propeller fan unit heaters with blower fan performance" in all types of industrial and commercial buildings.

IUHA Rated for Sound and Capacity. All 34 models are sound rated according to today's most reliable basis for judging sound emission. You may now select Little Giants sound coded for the environment they serve.

Little Giant Unit Heaters are tested and rated in accordance with the Standard Test Codes adopted jointly by the Industrial Unit Heater Association and the American Society of Heating and Air Conditioning Engineers.

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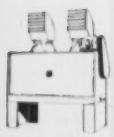

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LITTLE GIANT UNIT HEATERS

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Air Conditioning Eliminates Dirt Hazard And Builds Morale in Modern Plant

BY WAY OF follow-up on my article, *New Windowless Air Conditioned Plant*, in the September 1954 HPAC, I think enough time has elapsed for me to report that we are very pleased with the operation of the air conditioning system and with its benefits.

The main purpose of our air conditioning system is to purify the atmosphere in order to prevent the entrance of dust, dirt, and other contaminants into the relays and other electrical devices which we manufacture. This is of paramount importance to us as a manufacturer of high quality relays, since dust and dirt—natural enemies of relays—may, if introduced into a relay structure during the manufacturing stages, eventually cause contact failures after the relays have been installed. This purpose has been achieved to a most satisfactory degree.

Another benefit, of course, is the improvement of working conditions by making employees' comfort independent of the weather. Especially during the hot summer months, employees appreciate the clean, cooler air in the plant. Air conditioning is a good morale builder.

D. R. DOOLEY
Vice President in Charge of Sales
C. P. Clare & Co.

Find 'Homogenized Heat' System Practical For Commercial, Industrial Space

IN REFERENCE to the comments titled *Correct Volumes of Warm Air Supply, Return Rated Above Distribution Design*, by E. K. Campbell in the April HPAC—regarding the article, *New Church Heated by Large Sub-Floor Duct System*, by B. A. Kosarin in the September 1955 HPAC—there is much to be said pro and con for both sides. For my part, I favor a third system called Homogenized Heat. This system has been tried the past 10 years and proven practical in heating all types of commercial and industrial buildings in Southern California.

When we heat inside space, we are essentially creating indoor weather, and perhaps we should look to other sciences for an explanation of what develops. We can only suggest here the lines of thought involved.

In meteorology, the science of weather, a "homogeneous atmosphere" is defined as having the same composition throughout or having density constant with height. Average conditions of the atmosphere are represented, however, by a decrease in temperature with height, which is about 1/3 F per 100 ft and represents "stable equilibrium." When the temperature increases with height—very stable condition—there is said to exist an "inversion," which is a common result in most attempts to heat indoors.

The heating system is judged by the comfort it provides—which is in the area near the floor—and the degree of inversion. Floor panel heating is successful because the room air is slowly heated at the bottom. According to Professor F.W. Hutchinson in his article, *The Myth of the Indoor Sun*, in the December 1949 HPAC, nearly 99 percent of the energy leaving the panel goes directly or indirectly into convective space heating. When the room atmosphere is heated at the bottom, small thermal currents are spawned which float off gently into space and are absorbed, warming the space slowly but evenly.

Warm air heating systems are flexible in design, and therefore range widely between themselves in results. The laws of nature are immutable, however, and basic principles of density currents and associated flow patterns—as described by the U. S. Soil Conservation Service in research papers—should be given their due. It seems that a steady current of air may flow through, over, or under a mass of air of approximately equal temperature and density for long distances, provided the driving force by gravity, kinetic energy, or continuing flow gradient remains unchanged or unchecked. Simply it means this: a forced air outlet near the ceiling results in the establishment of an overflow density current at the top of the air in the room, while a wall outlet at intermediate height tends to establish an interflow density current which does not mix readily with the room air, while cold floor drafts are examples of underflow density currents. The result can be hodge-podge currents within the room or rooms. Tests by the University of Illinois show that cold air stratification on the floor can be controlled either with the use of low wall registers, 300 fpm warm air discharge, and intermittent circulation, or with use of high wall registers, 500 fpm warm air discharge, and continuous air circulation.

The volumetric theory of space heating depends on efficiently syphoning off the cold bottom layer of the room air reservoir while heat is introduced at any point in the reservoir including the top. The perimeter theory of heating depends on proper spacing and sizing of jets, the aspiration and mixing effects that occur near the floor, and to a small degree, the panel heating effect. The homogenized heat method depends on thorough mixing of a relatively small mass of warm air in the lower layers of a larger reservoir of air and then letting it diffuse naturally while seeking its own level. The initial velocity and temperature of the warm air are important, since it must penetrate and mix with the denser air. Forced air systems with baseboard grilles set for horizontal or downward throw are typical systems, while overhead blower type heaters, mounted low and set for 45 deg downthrow, are another. With one type of overhead heater, the blower moves approximately 300 cfm at 1700 fpm and gives floor-to-ceiling temperature variations of only 2 to 3 F in high ceiling rooms to 50 ft, and give little or no horizontal temperature differences from wall to wall.

JACK JANOFSKY
Kilbury Mfg. Co.

Heat Transfer in Snow Melting Systems Depends on Conditions Around Pipes

I MAINTAIN that the heat transfer from copper under the conditions described by F. F. Stevenson in his article, *How to Design and Install Snow Melting Systems*, in the January HPAC, is not any different than from steel. By heat transfer in this case, I mean the heat taken away from the surface of the copper and transferred to the panel surface.

It is well known that copper is a better conductor of heat than steel, but the transfer of heat to space or to an encasing material is another matter. It is recognized that the emissivity from copper tubing in air is appreciably less than from black steel, and to get better efficiency under these conditions copper is often painted black.

T. Napier Adlam, in his book, *Radiant Heating*, 1947 ed., in Chapter 8, page 98, states: "While the transmission of heat from copper pipe embedded in plaster or concrete is substantially the same as for wrought iron or steel pipes, the transmission of heat from copper tubes when placed in air space is found to be less than with ferrous pipes."

As heat transfer depends on environments and the transfer from coils in concrete depends upon the conductivity of the concrete, there would be no particular advantage for any pipe material, and I believe this is generally recognized.

In further support of this point, I cite a reference to experiments made at the American Society of Heating and Air-Conditioning Engineers' Research Laboratory at the U. S. Bureau of Mines Building in Pittsburgh, Pa., about the relative heat transfer capacities of ferrous pipe and copper tubing. These tests, I understand, were reported in the Journal section of the January 1932 HPAC. This reference is as follows:

"The small temperature difference existing between the steam and the outside surface of the pipe bears out the generally accepted fact that the important factor in resistance to heat flow from a bare pipe is in the transfer from the metal surface to the air, rather than the thermal resistance of the metal itself." And the article concludes: "The heat loss from bare copper pipe is approximately 54 percent of the loss from black iron pipe of the same nominal size."

Also, I quote from an article, Heat Flow Within a Concrete Panel," by Humphreys, Nottage, Franks, Huebscher, Schutrum, and Locklin, in the Journal Section of the April 1950 HPAC. This first paragraph, page 112, reads as follows:

"The pipe material—ferrous or non-ferrous—was ruled out as an important thermal variable for the concrete slabs involved. Calculations showed that the thermal resistance of the pipe, regardless of the metal used, was entirely negligible in relation to the other thermal resistances involved. The heat flow was, therefore, analyzed in terms of the pipe surface temperature rather than the water temperature."

In conclusion, I contend that heat transfer depends to a very great extent on the conditions surrounding the pipe coils with the same temperature of circulating heating medium.

GEORGE D. LAIN
Research Engineer
Committee on Steel Pipe Research
American Iron and Steel Institute

Heat Transfer of Snow Melting Pipe Depends on Installation, Coefficient

REFERRING to George D. Lain's last paragraph of his comments in the February HPAC and those above on my article, *How to Design and Install Snow Melting Systems*, published in the January HPAC, I assume that Mr. Lain is objecting to my giving copper tubing a higher heat transfer rate than steel pipe. Of course we know that copper has inherently a higher heat transfer coefficient than steel, but I will concede that the manner in which the tube or pipe is placed in the slab or under it, has as much to do with the actual heat transfer as the theoretical coefficient of heat transfer for the material. However, I have used these rules of thumb on a number of installations and they seem to work out all right. They are well on the safe side.

F. F. STEVENSON
Consulting Engineer

what they are doing with

REVERE COPPER WATER TUBE

FIRST LUTHERAN CHURCH
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On this job the 5,000 feet of ½" Type L Revere Copper Water Tube in standard 60' lengths meant fewer fittings. The sure soldering of copper meant tight joints. The non-rusting qualities of copper means no clogging or reduction of flow. Wrap up all the advantages of using Revere Copper Water Tube in radiant panel heating systems and you have an installation that is low in cost and high in reliability. Ask the contractors. They say copper costs less than rustable materials and can be depended upon to perform for years.

The beauty of heating a church by radiant panels is that traditional as well as modern architectural design may be used without having to allow for outlets or radiators. It is the number one method of heating churches and similar permanent structures. And, when installation is completed panels are invisible.

The inherent qualities of Revere Copper Water Tube also make it the choice of the "on-the-ball" architect and contractor for hot and cold water lines, underground service lines, processing lines, drainage and waste lines, vent stacks. See your Revere Distributor for your needs. And if you have technical problems involving the best way to use Revere Copper Water Tube, one of our Technical Advisors will be glad to help.

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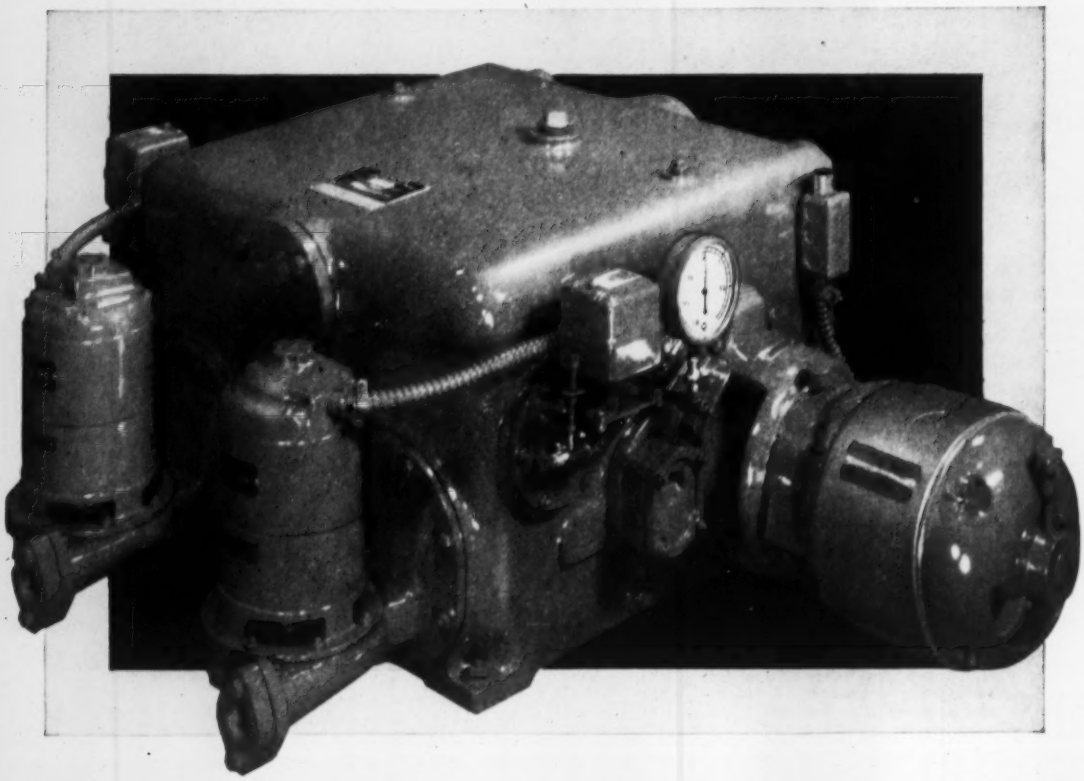
THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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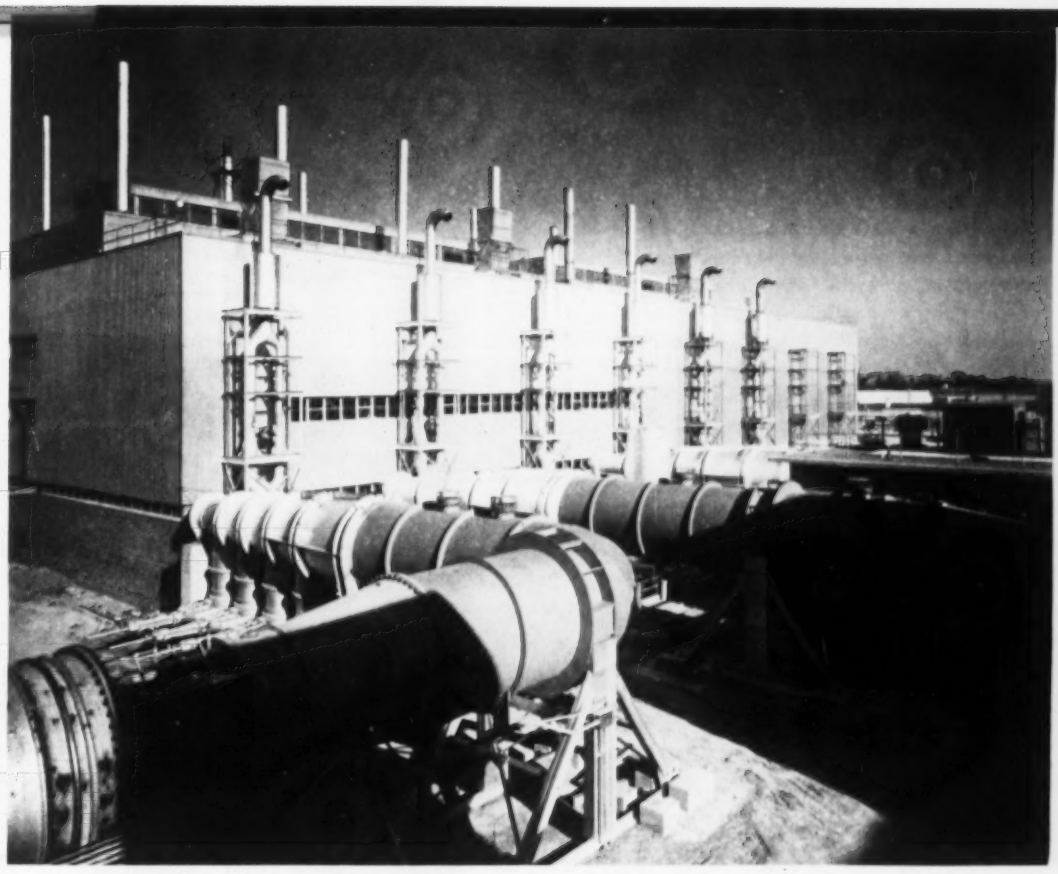


HIGH PRESSURE BLOWER WING supplies up to 1 million cfm of conditioned combustion air to engines undergoing test in the test wing. Air taken in through filters and silencers to three 6000 hp ram air blowers is then cooled and dehumidified in three stages

HPAC VISITS NEW FACILITY TO SEE HOW . . .

Huge Air Piping Systems Serve Navy's New Jet Engine Test Lab

. . . to simulate flight conditions from sea level to 65,000 ft, with air temperature as low as –65 F, variable humidity, and air velocity from subsonic at sea level to supersonic at altitude

To test and evaluate aircraft turbojet, turboprop, ramjet, and pulse-jet engines for the Navy, the most complete and powerful facility in the world was recently completed at West Trenton, N.J. It cost $32.5 million, not including $8 million provided for later expansion. Provisions for air silencing alone cost approximately $3 million. Flight conditions from sea level to an altitude of 65,000 ft can be simulated, with atmospheric temperature as low as —65 F, variable humidity, and air velocity from subsonic at sea level to supersonic at altitude.

How Laboratory Funteions

Air drawn into blowers in the high pressure blower wing is conveyed via large piping through several stages of air treatment for dehumidification, refrigeration, and rarefication, fitting the stipulated requirements of a given test. Treated air is then conveyed to any one or combination of three types of test units: turboprop cell, sea level turbojet cells, or altitude chambers.

An engine operating on a test stand in any of these units generates exhaust gases ranging, under certain conditions, up to 3500 F. These gases must immediately be wholly exhausted from the altitude chamber to

maintain the air in this unit in conformity with the test conditions. This is true, also, in some tests in the turboprop cell. To accomplish this, the gases are cooled by large exhaust gas coolers, exhausted by giant blowers, and dissipated through conditioning rigs and mufflers in the exhaust blower wing. Also playing a major role in the cooling process is water from the 1.2 million gal reservoir, which is circulated through a complex system of heat exchangers and intercoolers throughout the laboratory area, and then returned to the reservoir via cooling towers. Test conditions in each unit are established from the control room by remote control. Here, too, test results are registered on a highly complex system of instrumentation.

Tests Are of Three Types

Steady state tests will comprise most of the work. This includes engine qualification and calibration.

Transient tests will determine engine characteristics during acceleration and deceleration.

Environmental tests will check engine performance under various severe climatic conditions.

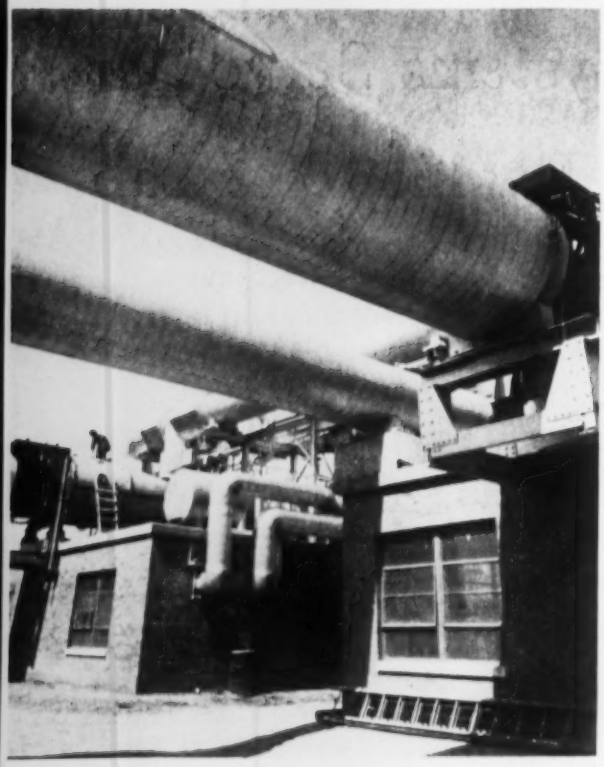
Station Consists of Three Wings

High Pressure Blower Wing supplies conditioned combustion air to engines undergoing test in the test wing. Atmospheric air is taken in through intake filters and silencers to three ram air blowers of 6000 hp drive each, which combined are capable of delivering over 1 million cfm. Air from the blowers is piped through air treatment rigs and control valves to any one of five engine test cells through 60 in. diameter pipes, with insulation up to 12 in. thick. The air piping is of a common manifold system with takeoffs by main headers that contain a characterized flow control valve and connect direct to the engine cell. Air cooling and dehumidification take place in three successive air treatment rigs of approximately 23 ft diameter; the primary rigs cool and dehumidify the air from 98 F to +41 F by means of separate water and fluorinated hydrocarbon refrigerant (No. 12) coils; the secondary rigs cool and dehumidify to −23 F by means of a refrigerant coil that is continuously sprayed with a controlled water-glycol mixture. The third air treatment rig cools the air from −23 F to −67 F or gives exact control of any intermediate temperatures by means of trichloroethylene — brine — coils, the brine being cooled by a separate refrigerant No. 12 to brine heat exchanger. Air temperatures to simulate aerodynamic heating of high speed flight are obtained with the same coils by utilizing a separate steam to brine heat exchanger. The three stage refrigeration system utilizing centrifugal compressors is within the blower wing. The blower building is 100×150×60 ft high.

Test Wing, for the testing of engines in cells at various pressures, is supplied with refrigerated dehumidified air to simulate flight conditions.

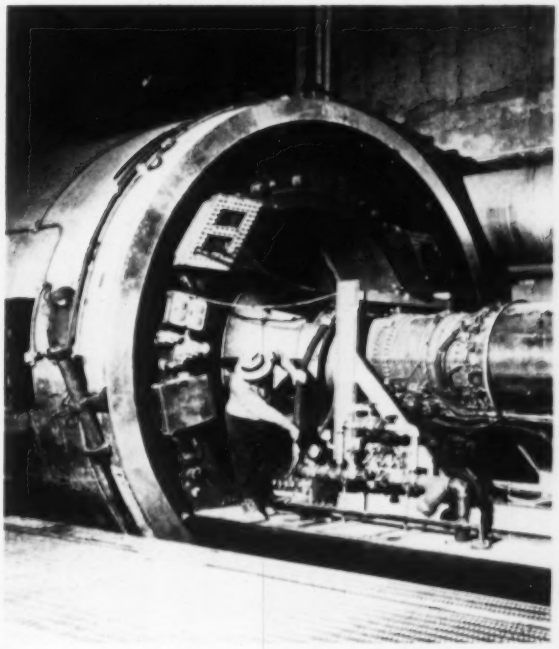
This test wing consists of one turbopropeller test house which contains a test cell, propeller shop, fuel room, and soundproof control room. Also included is an altitude test house which contains two altitude chambers, necessary piping for fuel, fuel room, and other facilities such as soundproof control rooms, etc. Each altitude test cell is a metal cylinder 65 ft long and 15 ft in diameter. Two sea level turbojet test cells comprise the third section of the test wing. Included in these test cells are the fuel room, soundproof control room and other necessary facilities.

In the turboprop house, tests can be conducted through the entire range of flight conditions with the propeller subject to sea level conditions. Propeller air is drawn in through a cone shaped orifice that is adjustable to the circumference described by the propeller. Also, an air stream can be played at various positions on the propeller to simulate the eccentric loads that occur in banking, diving, climbing, etc. In addition, treated refrigerated air can be conveyed into the engine itself. The propeller air is exhausted through a stack in the test wing, while engine exhaust is cooled and dissipated through the exhauster wing.



AIR PIPING, 60 in. in diameter and with insulation up to 12 in. thick, is of a common manifold system with takeoffs by main headers containing a characterized flow control valve. Piping connects direct to the engine cell

INSIDE ALTITUDE TEST CHAMBER turbojets are tested with or without ram air. In sea level test cells only, four water spray rings directly behind the engine cool the exhaust and prevent its heat from damaging sound attenuation material



ALTITUDE CHAMBER OPEN shows J40 engine being readied for test. Upstream is at left. Chamber is one of two altitude test cells, each 68 ft long and 18 ft in diameter

In the turbojet cells, tests for this type of engine with or without ram air are also conducted at varied sea level flight conditions. Combustion gases are exhausted through sound attenuating materials in a stack in the test wing. In sea level test cells only, four water spray rings directly behind the engine cool the exhaust and prevent its heat from damaging the sound attenuation material which deadens the loud roar of the engine under test. The first spray ring cuts in when the exhaust temperature reaches 330 F. Successive rings begin operating as the temperature climbs to 460 F, when an alarm is sounded.

In the altitude test house, turbojet engines are tested for a whole range of flight conditions from sea level to an altitude of 65,000 ft. Here it is of paramount importance to maintain the air in the chamber at the test-prescribed levels of temperature, humidity, density, and flight speed. Accomplishment of this brings into play the extensive cooling and exhauster equipment in the exhaust wing.

Exhaust Blower Wing contains three stages of exhausters. In the first stage, four exhaust blowers, each driven by a 4500 hp electric motor, can simulate altitudes up to 23,000 ft. In the second stage, two exhausters driven by 3500 hp motors increase the altitude to 44,000 ft. The third stage consists of a single exhauster requiring 3000 hp and takes the cell altitudes up to 65,000 ft.

Other equipment includes sound absorbing equipment, mufflers, and temperature reducing equipment required in the process of exhausting engine air from altitude chambers and from the turboprop cell. All exhauster air piping is interconnected by large diameter headers, and direction of air flow is controlled by large gate valves. This wing is 138 × 230 × 60 ft high.

Between the test wing and the exhaust blower wing are two mufflers for turbojet exhaust and the exhaust gas coolers for the test cells having altitude connections.

To weld 42 to 60 in. OD stainless steel clad pipe (air inlet piping to engine test cells, a carbon rod pass was made on the outer side. After this was completed, the weld was cleaned and chipped back on the inside of pipe. Then two passes with 25-20 stainless rod were made on the inside. Welding was completed on the outer side with a carbon rod.

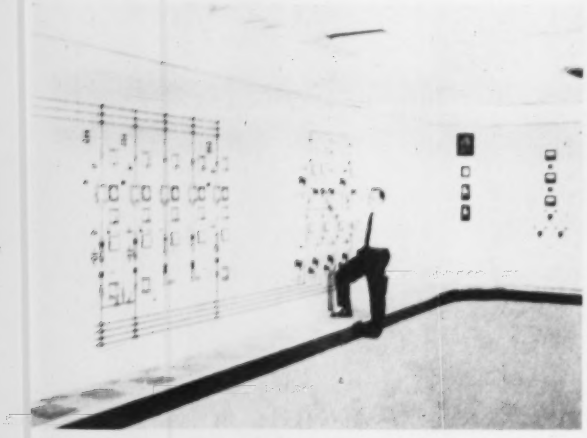
Exhaust gas piping, from 54 in. to 10 ft in diameter, was welded with a carbon arc rod. Where possible, pipe was prefabricated and delivered to the site for installation. Flanged pipe was delivered with one flange loose and welded in place in the field.

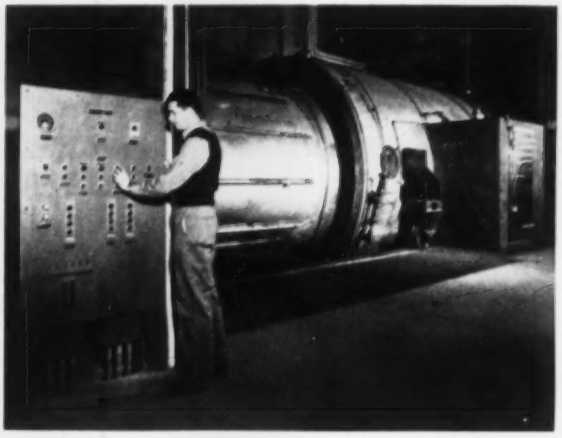
Design Solves Unique Problems

The design of this installation was unusual in many respects, the unique scope of which involved:

1) Design of new type coolers to cope with turbojet engine exhaust gases ranging up to 3500 F, before they enter the exhauster wing.

2) Extensive research and investigation for handling the large quantities of air involved in the very high degree of vacuum required by the simulated altitude of 65,000 ft. Existing engineering tables did not extend over the wide ranges required.





SUPERVISORY CONTROL ROOM, left, on the front of the test wing, houses a 35 ft central control panel by which engineers supervise the functioning of the entire laboratory and give permission to operators, right, to set equipment in motion. Indicators check 358 temperatures

3) Extensive investigation to determine the best method for dehumidifying combustion air to prevent condensation on the test instrumentation installed on the engines. Direct refrigeration was finally adopted.

4) Previous experience showed that extensive corrosion occurred inside the combustion air piping, with rust and metal flakes flowing with the air stream into the engine under test and causing serious damage. Experience also disclosed that no external applications inside the piping can prevent this corrosion. Hence, it was decided to use stainless-clad carbon steel in this piping system.

5) Because of the laboratory's unique magnitude, especially with respect to the huge air flow rates involved, piping and equipment that are normally catalog items could not be used and either had to be developed or adapted from manufacturers' standard equipment.

6) Because the laboratory must make precise tests of engines under abnormally extreme conditions of temperature and humidity, air treating facilities for ordinary refrigeration and air conditioning could not be employed. This necessitated larger refrigeration equipment and greater cooling tower capacity.

7) All heavy machines such as combustion air blowers and exhausters were set on their own individual foundations separated from building structural steel to minimize vibration.

8) Extensive use of sound attenuation materials and equipment is made throughout the laboratory to keep interior and exterior noise level at a minimum. This phase of the project alone cost approximately $3 million.

9) The unusually large size of the electrical capacities necessitated special study and design of electrical equipment, ductwork, and insulation methods.

10) The laboratory is so designed that units can be easily added to take care of future alterations."

Control Center Elaborate

Heart of the test station is a supervisory control room built on the front of the test wing. Here, a 35 ft central control panel equipped with lights, dials, gages, and controls allows engineers to supervise the functioning of every part of the laboratory, give permission to operate equipment, and direct air flow.

Controls include more than 23 miles of copper tubing plus 26 miles of thermocouple wiring which focus vital information from all parts of the laboratory on the panel for the engineers to observe during engine testing in the cells.

Controls are of the "permissive" type. Manual, on-off interlocks prevent any part of the laboratory's machinery from being started until all operating requirements have been satisfied.

Engineers do not control any of the machinery; they merely give permission to operators to set it in motion. They act as coordinators to assure that all parts of the complex laboratory function as a team and that safety conditions are observed.

Any emergency can be spotted immediately in the supervisory control room, and by pushing a single button the entire operation is stopped.

The indicators on the control room panel check 348 temperatures throughout the facility. Three hundred temperatures are easily verified by a dial telephone which incorporates a special check system.

Laboratory personnel in individual soundproofed control centers near each test cell operate the engines, physically watching the engine under test and by means of elaborate instrumentation.

Operating personnel can communicate with each other only by going through the control room. Control engineers can talk with personnel anywhere in the laboratory through a closed loop communication system.

Auxiliary Elements Serve Lab

1) The Delaware river pumping station about two miles from the main site supplies cooling water required by the various intercoolers, heat exchangers, and exhaust coolers employed in the process of drastically lowering the extremely high tempera-

ture of the exhaust gases generated during tests. The pumping capacity is from 2500 to 5000 gpm. Water is brought to the site through a 20 in. pipe line, passing through the water treating plant into a 1.2 million gal reservoir built at the base of the cooling tower installation.

2) The water treatment plant houses a reinforced concrete coagulation tank measuring 31×70×12 ft deep and an adjoining chemical storage and mixing house 36×38 ft and two-stories high (first story 15 ft, second 11 ft).

3) The 1.2 million gal reservior of reinforced concrete at the base of the water cooling towers is 240 × 65 × 13 ft deep. Reinforced concrete pipes 60 in. in diameter supply water from the reservoir to the test area and return it under a pressure of 100 psig to the cooling towers. Since it is uneconomical to pump the full cooling water requirements from the Delaware river, the water is recirculated from the reservoir through the cooling towers, thus necessitating pumping from the river only that water lost through evaporation.

4) There is one cooling tower with 12 fans, each with a capacity of 5000 cfm to reduce the water temperature from 115 to 90 F under the normal range of atmospheric conditions.

The cooling tower water piping system consists of approximately 3000 ft of piping, below and above ground. The below-ground piping is of concrete construction and above-ground construction is steel. The piping diameters vary from 30 to 60 in. for the supply lines and 18 to 54 in. for the return lines.

5) The main electric supply enters underground at a northerly substation at 132,000 volts and continues underground to a southerly substation. From these two points, service is supplied to the high pressure blowers and the exhaust blowers, the points of heaviest demand, and is also distributed throughout the project.

6) Eighteen steel tanks on concrete cradles above ground and protected by earth dikes store engine test fuel. A system of overhead pipe lines connects these tanks with the test wing.

The fuel system pipe lines are above ground and are of a loop type with 4 in. supply and 3 in. returns. These lines originate at a centralized pumping station at the tank storage area and supply any of five existing test rooms. Fuel is conditioned within several fuel rooms in the test wing; fuel is filtered, metered, and heated or cooled prior to being taken in by the engine. Automatic fuel shutoff valves are within the test wing fuel rooms and are actuated by the individual test cell fire systems.

7) An overhead water tank of 100,000 gal capacity primarily serves the fire protection system.

A network of fire mains to each fuel room, two sea level turbojet cells, and the turboprop cell serve the water deluge system. The mains are kept at 100 psig pressure with a small boost pump. When the deluge system is actuated, a 1000 gpm pump automatically starts, with additional pumps available to the deluge system.

Also for fire protection, a fixed 1 ton CO_2 system is installed for use with the two engine altitude chambers. This system may be actuated either automatically or manually.

8) A railroad siding serves test fuel tanks.

9) A previously existing structure of approximately 100,000 sq ft was altered for use as auxiliary shop containing shipping and receiving departments, engine accessory and overhaul shop, metal and welding shops, live and dead storage spaces, and toilet and locker rooms, and a cafeteria for personnel.

10) A boiler house supplying heating and process steam for the test area has oil fired boilers, with provision for conversion to coal if necessary. Steam is distributed underground to various parts of project. Boiler fuel storage tank and pump house are adjacent to railroad siding.

11) A main pump house with pumps for fire line, process water, and back wash of supply line from Delaware river also houses water cooling equipment.

Consulting engineers were Burns & Roe, Jaros, Baum and Bolles, and Frank Grad and Sons.

Why the Station Was Built

Before the jet age opened, the Navy's aeronautical engine laboratory at Philadelphia conducted the first engine calibration made in this country under simulated altitude conditions.

With the advent of jet engines, development of facilities to test them under simulated altitude conditions became urgent. Large facilities with capacities far beyond those already in existence were required. In 1944 the Navy Dept., Bureau of Aeronautics, initiated studies to establish basic criteria and requirements for a new testing facility.

In 1951, the Trenton project was commissioned as a research and development activity of the Navy Dept., Bureau of Aeronautics. The station is under the military command and technical coordination of Commander, Naval Air Development and Material Center, Johnsville, Pa. This command coordinates all aeronautical research and development effort in the Fourth Naval District. It is currently headed by Rear Admiral S. B. Spangler, who as director of the Navy's Power Plant Design Division in the Bureau of Aeronautics in 1943 conceived the idea of establishing the station.

Technical operation will be largely in civilian hands, with the Navy directing administration.

To simulate ram air conditions met by jet engines, total compressor capacity is over 1 million cfm through the three wings. The total air flow distance is 700 ft.

The laboratory's $40 million cost may be compared with the $50 million that the government expends in developing one modern jet engine from the design and drawing board stage to the final finished product.

General Motors' new Technical Center, seven years under construction, was dedicated last month. The Research Staff Administration Building — one of the last major buildings completed — is air conditioned with a 1250 ton double duct high velocity system. In addition to performance standards, the author gives five tips from GM's experience.

High velocity air conditioning was chosen for the 17 office and laboratory buildings in the new General Motors Technical Center, Detroit, Mich., mainly because of the space saved by the smaller ducts used. Other advantages considered were:

- Smaller ducts are easier to install and insulate.
- A double duct supply system with air velocities of about 5000 fpm is highly responsive and flexible.
- High outlet velocities of about 2000 fpm permit greater temperature differentials between supply and room air, reducing the quantity of chilled air required.

In the first three major staff buildings, the system consisted of cyclone type centrifugal air washers and dual supply ducts through which air at velocities up to 6000 fpm were delivered. The velocity was reduced to 3000 fpm in damper controlled mixing boxes and admitted into the offices through centrifugal ceiling outlets.

This system proved difficult to balance. These difficulties were overcome by installing a balancing system of pressure regulating dampers. Noise was also a problem, which was overcome by acoustical treatment of the supply outlets and installation of vibration eliminators in the ducts.

The last major building to be built was the Research Staff Administration Building. This 690 × 60 ft building contains interchangeable laboratory and office space, a 123 seat auditorium, and a library on the top floor. The building was originally designed to accommodate the 20 ft high centrifugal air washers, but it was found that conventional air conditioning equipment could be installed to serve this high velocity system.

Performance Standards Set

During the summer under design conditions of 95 F dry bulb and 75 F wet bulb, the inside conditions are maintained at 80 F DB and the rela-

High Velocity System Air Conditions GM Technical Center

By Fred H. Couts
Plant Engineer
Service Section
GM Technical Center

— as told to HPAC

tive humidity at 50 percent. During the winter and under outdoor design conditions of −10 F, the inside temperature is maintained at 75 F and the relative humidity at 30 percent.

Noise from the equipment, ducts, and air is kept below 45 decibels in the offices, 40 db in the conference rooms and at about 30 db in the auditorium.

A minimum of 20 percent of outdoor air is admitted at all times, and a minimum of six air changes per hour determines the air flow rate in all occupied areas.

The total air conditioning load for this building is 1250 tons of refrigeration capacity, which may vary and fluctuate widely in various areas. Sixty compressors of 20 hp capacity connected in parallel supply 4000 gpm of chilled water at 42 F to meet this maximum load. One water chiller is connected to each three compressors.

Conditioned air is supplied at 5000 fpm through a series of double duct risers, one hot and one cold, with parallel 48 × 20 in. cold and 28 × 20 in. hot horizontal duct takeoffs laid above the corridors on each floor.

The main ducts were designed by modified static regain principles, with the ducts the same size throughout. This reduces power-consuming pressure losses and maintains relatively constant static pressure at all points in the system.

Mixing boxes are about 5 ft apart between the main ducts and supply outlets. These boxes are usually installed immediately below the ducts in the corridors to provide accessibility. The boxes have two functions: (a) to proportion and mix the hot and cold air so that each outlet supplies air at the desired temperature to satisfy the heat loads of the space served (the temperature of the air in the cold ducts is maintained at 55 F throughout the year; the hot duct air temperature varies inversely between 80 and 155 F with outside temperature); and (b) to act as a sound attenuator. The boxes have built-in sound baffles and acoustical lining.

Due to the high variation of ventilation requirements in the building,

• no 'today' here

Guarding against the future as if it were the present, General Motors Corp. last month dedicated its much heralded Technical Center. Ranking as one of the world's great industrial research centers, it was built with the idea that science is a source of economic energy for industry, the nation, and the world.

The 330 acre, 25 building center at Warren, Mich., 25 miles north of Detroit, is the workshop of over 4000 engineers, researchers, stylists, designers, mechanics, machinists, and other specialists. Their job is not only to improve today's techniques, methods, and products, but also to scan new horizons and chart new courses.

GM President Harlow H. Curtice has said: "There are no 'todays' at the Technical Center. This is our investment in tomorrows."

Four central staff organizations — Research, Engineering, Styling, and Process Development Section — plus the Service Section are housed in five building groups along three sides of a 22 acre, 7 ft deep artificial lake.

Dominating the skyline is a 140 ft 250,000 gal stainless steel clad water tower. Equally dramatic is the aluminum sheathed styling auditorium, with its domed ceiling 65 ft high and 188 ft span.

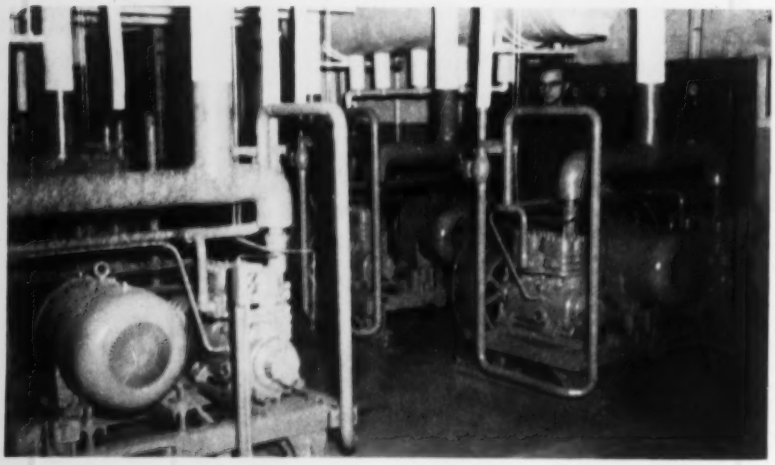
At the north end of the site are a gas turbines research building, research wind tunnel, and research isotope laboratory.

Major building groups are connected by more than a mile of underground tunnels. Above ground the site has approximately 11 miles of roads. Large parking zones, screened by trees and shrubbery, are situated beside each building group.

Construction of the center began in 1949. Occupancy of the first building was in 1950, and the last of the major operating units moved into its quarters in late 1955. Finishing touches were completed before the official dedication.

CEILING OUTLETS, spaced about 10 ft apart and connected to the mixing boxes by flexible round ducts, admit up to 225 cfm of conditioned air at velocities up to 2000 fpm. These outlets are built with sound absorbing material, and some have sprinkler heads incorporated

RETURN AIR FLOW THROUGH CORRIDOR is limited to 55 fpm to avoid drafts. From corridor, air is collected into vertical shafts leading back to the equipment room



SIXTY 20 HP COMPRESSORS in parallel supply 4000 gpm of chilled water at 42 F to meet the maximum load of 1250 tons in the new Research Staff Administration Building. One water chiller is connected to each three compressors

it was necessary to provide for adjustment of the air flow from the mixing boxes. An adjustable mechanical linkage of the hot and cold dampers permits the air supply to be adjusted when the laboratory heat loads change without making a major alteration in the basic air distribution system. Calibrated heat load scales on the quadrant dampers at each mixing box simplify the adjustments. The hot and cold mixing dampers are linked together and are motor operated. They are controlled by individual room thermostats 5 ft from outside walls. The dampers are designed to work in parallel to be sure that a proper balance between the combined air volume and temperatures of the mixture is maintained. The hot damper has to be closed tight to avoid leakage of air from this duct during the cooling season.

Two main types of supply outlets are used. Ceiling outlets, spaced about 10 ft apart and connected to the mixing boxes by flexible round ducts, admit up to 225 cfm of conditioned air at velocities up to 2000 fpm. These outlets are shaped to diffuse the air around the room near the ceiling. They are built with sound absorbing material on an inner cone and are free of vanes to reduce noise. Some have sprinkler heads incorporated in the design.

Perimeter offices have wall outlets which admit 900 cfm of air at 2000 fpm from a $11\frac{1}{4} \times 56$ in. horizontal slot just below the ceiling. These high outlet velocities increase entrainment of room air with the supply air, thus avoiding drafts.

Return air is collected from corridors into vertical shafts leading back to the equipment room. To avoid drafts, air flow in the corridors is limited to 55 fpm. Air pressure in the building is kept about 0.02 in. water gage above outside pressure, which in effect pressurizes the building and eliminates drafts at the entrances.

Control of the system is fully automatic, consisting of pneumatic and electronic controls. Some of the economizing features that have been experienced with this system are: (a)

throttling control of air supply to reduce steam consumption at the main heater; (b) bypass dampers to allow return air to be used for reheat, reducing steam consumption in the after-heater and facilitating humidity control; (c) when outside temperature permits, outside air is used directly, thus saving refrigeration in spring and fall; (d) the supply fan speed is reduced to half speed at nights and on week ends, thereby reducing power consumption to one-eighth of full speed consumption.

Five Tips from GM's Experience

1) High velocity systems, operating at duct velocities over 4000 fpm, require special pressure control, acoustical treatment, and accurate engineering, both in design and in installation. Slight obstructions or leaks in ductwork that might escape notice in a low velocity system become noisy and prevent close control with higher duct velocities.

2) Small ducts save space. If the duct velocity is doubled, the size of the duct can be halved for a given air flow rate. But greater fan pressures are required to overcome both the increased friction resistance of the smaller ducts and to circulate the air at the higher velocities. Doubling the static pressure nearly triples the fan horsepower required. However, careful design of the air distribution system — using the static regain principle in the duct design — can keep the duct pressure loss to an acceptable level; and since the pressure drop through the equipment, i.e., heaters, filters, etc. and the room outlets are changed from a conventional system, the resultant increase in fan horsepower may not exceed 30 percent.

3) High duct velocities should be used only where space saving is necessary, since the operation of systems with larger ducts is more economical. For a given duct velocity, friction losses are considerably greater in the smaller diameter ducts, therefore lower velocities should be used in the smaller branch ducts. These ducts can often be flexible to facilitate relocation of ceiling outlets.

4) Rectangular ducts need less head room and are more readily available than round ducts. But they must be braced, and they must be made of heavier gage metals. Round ducts can often be fabricated in relatively long lengths, thus reducing the number of joints and saving time in installation.

5) Airtight ducts are essential. Each section can be checked for leaks by blocking it off and temporarily attaching an auxiliary blower producing a pressure up to 8 in. WG. Leaks may be easily detected by the noise generated. Expansion joints should be provided to prevent leaks from developing as a result of duct movement when temperature changes occur.

Architects and engineers for the General Motors Technical Center were Smith, Hinchman & Grylls, Inc. The architect was Eero Saarinen & Associates. The engineers and contractors for the high velocity air conditioning system were Thermo-Tank, Inc.

ON THE JOB

Mineral Wool Insulation Applied in Boiler Room

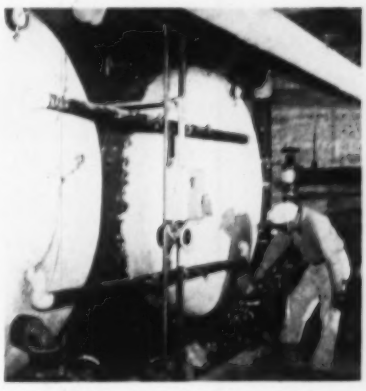
. . . to increase thermal efficiency

Mineral wool insulating materials were specified in the new South Philadelphia, Pa., high school to increase the thermal efficiency of the boiler plant, according to the Baldwin-Hill Co.

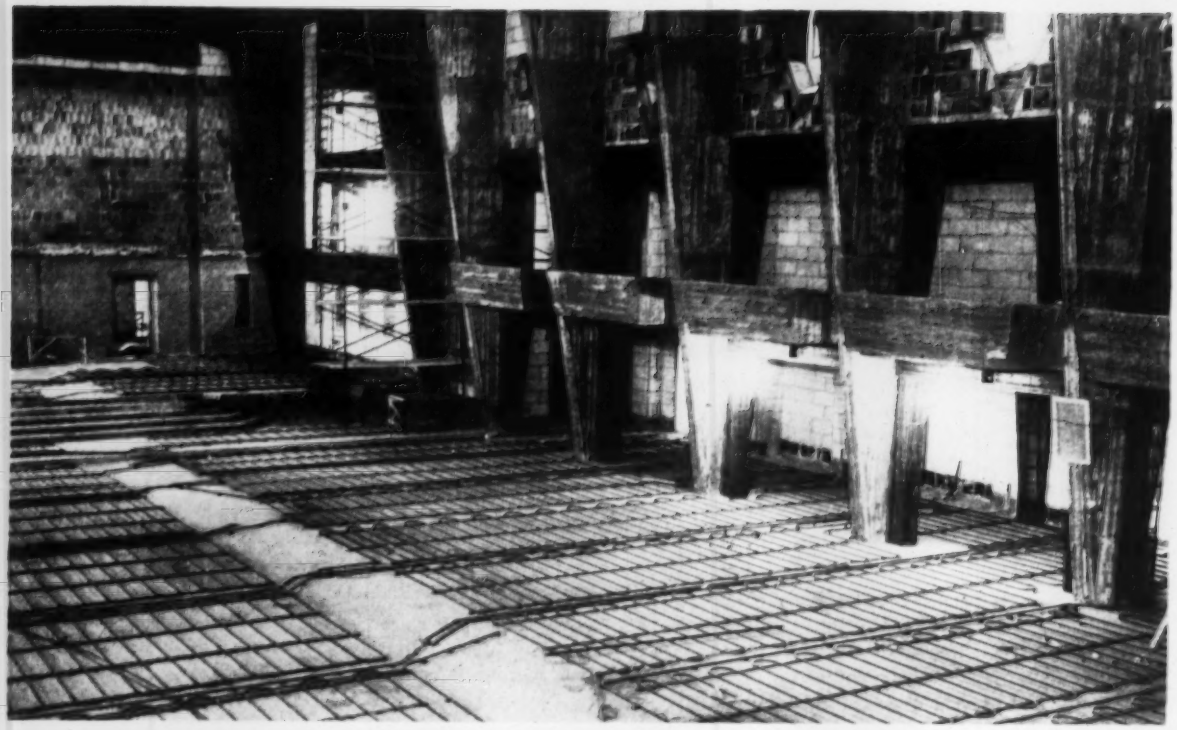
Boiler breechings were covered with high temperature mineral wool insulating blocks, 2 in. thick and capable of withstanding temperatures up to 1700 F. They are secured by $\frac{3}{4}$ in. steel bands. Tie wires, anchored to pencil rods welded to the surface of the breechings, extend between the block joints to hold the bands. The pencil rods extend along the duct surface parallel to the long axis of the blocks beneath the block joints at intervals corresponding to the block width. A plasterers' corner head was attached to corners.

Over the mineral wool blocks was applied one coat of white drying insulating-finishing cement.

To insulate the pneumatic tanks in the boiler room, felted mineral wool block, designed for service at temperatures between −150 and +300 F, was applied. Molded mineral wool pipe covering insulates the overhead high temperature line. The insulating-finishing cement was applied finally to the tanks and piping also.



MINERAL WOOL INSULATION was applied to the breeching, piping, and pneumatic tanks of this school boiler room



CHAPEL HEATING SYSTEM includes hot water panels in the floor, balcony, and two levels of galleries. About 18,000 ft of steel pipe and copper tubing is installed here and in other areas

Hot Water Panel Heating System To Save Fuel in New Institution

. . . by maintaining a higher mean radiant temperature

By Oscar Dorval
Leblanc, Montpetit & Dorval, Consulting Engineers

As told to Edmund T. Nesbitt

A SAVING of about 10 percent in fuel oil costs for heating is expected to result from the installation of radiant heating panels in two sections of the large new institutional building of the Sisters of Charity at Giffard, near Quebec City, Canada.

The anticipated fuel saving is due mostly to the fact that in a radiant heating system a higher mean radiant temperature can be obtained. Thus, the final desired temperature is lower than with the conventional types of heating systems. In this case, a temperature of 68 F will be maintained in the panel heated areas in the heating season, whereas a temperature of 72 F will be maintained in the conventionally heated areas.

The huge concrete frame and limestone H-shaped structure, with a large chapel connecting the hospital and residence wings, now nearing completion, will be occupied this summer. The eight-story building containing 6.5 million cu ft of space will house about 850 nuns. It cost $6 million.

Radiators and Convectors Heat Other Areas

Most of the residence and hospital areas are heated by wall suspended hot water radiators — recessed convectors in one wing — fed from three steam injection heat exchangers or water heaters connected to two large oil fired steam boilers.

Areas in which radiant heating coils have been installed are the chapel floor, balcony, and two levels of galleries along one side of the 75 by 125 ft. chapel; the vestry and dressing room area behind the chapel; and the 30 by 60 ft reception hall extending over the main entrance. A total of about 18,000 lineal ft of steel pipe and copper tube is installed. The system is divided into several zones controlled by indoor and outdoor thermostats.

Keep Chapel Panels at Same Temperature

About 14,000 ft of 1 in. steel pipe, welded to transverse steel angle strips, is installed in the chapel areas, which comprise eight separately controlled zones. Each floor panel is 250 ft long. This piping is buried 2½ in. in concrete over a concrete base. The surfacing material is terrazzo. There is no special insulation under the chapel except the insulation of the mains, since the basement is occupied by the cafeteria and dining rooms. Each zone has an individual shutoff valve. A master thermostat outside the chapel is connected to the single main feed line to the single centrifugal circulating pump, which is in the boiler room wing opposite the chapel. Sixty air valves vent the coils in the chapel areas. There are no radiators in the chapel.

The panels are kept always at the same temperature throughout the season, whether the chapel is occupied or not. One reason is that the chapel may be in partial use at any time. Another is that lowering of the temperature in the chapel would tend to draw heat from adjacent areas if many of the doors on floor and balcony and gallery levels were left open.

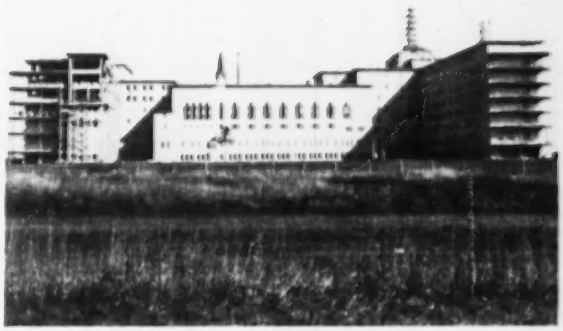
A 20 by 60 ft gallery for tubercular patients overlooking the altar area has a radiant panel of 132 ft of copper tubing in the ceiling, as well as a similar length of steel pipe in the floor panel.

The total cost of the radiant heating system for the chapel itself was about $10,000.

Some Panels Are in Subfloor Air Space

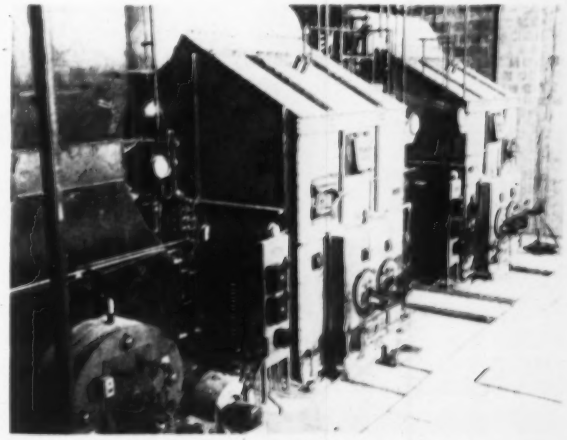
The reception hall, of unusual design, is built on pillars and extends 60 ft from the main building over the entrance stairway. Its exposure necessitated special cork slab insulation in 3 ft deep subfloor and ceiling air spaces. Slabs 2 by 3 ft in size and 1¾ in. thick were applied to the interiors of the air spaces with an adhesive compound, which also sealed the joints to keep out cold and dampness. Quebec winter temperatures sometimes go down to −25 F for a few days and often remain near zero for a week at a time. The radiant panels are in the subfloor air space.

The reception hall is also partly heated by conventional radiators. The use of both kinds of heating in this room is expected to keep the temperature constant even in zero weather. The bare coils in the floor air space are supplied, via three-way valves, by the heat exchanger for this wing. The same heat exchanger serves



CHAPEL WING of convent is between hospital wing, left, and residence and training school wing, right. Main dining room is below chapel. Chapel is 75 x 125 ft

CONVENT ENTRANCE has reception room, with radiant heating in floor and ceiling, over the portico. Gray limestone was used for exterior walls



THREE BOILERS, in wing opposite chapel, supply steam to heat exchangers which supply hot water for the heating system and other needs. The smaller one, left, meets summer needs

the conventional wall radiators in this wing but not others. The return main of the coils is branched on a separate circulator.

The flow temperature of supply hot water to the radiant panels is 110 F; to the conventional units, 170 F. The temperature drop in the radiant heating system is 10 F; in the conventional system, 15 F.

Pressure in the hot water panels is 40 psi. For the panels in the chapel, a pump circulates 75 U.S. gpm.

System Is Electronically Controlled

Controls are of the electronic type. In the chapel a thermostat on the main level is installed so that it is not affected by the sun or outside exposure. A master panel receives the signals given by both the outdoor thermostat and the room thermostat. The combined result is transmitted to the three-way valve. At the other end, the submaster controls a single-way valve on the supply steam pipe to the heat exchanger according to the outside temperature.

In the reception hall a thermostat operates a three-way valve on the main for radiators. Another thermostat in the air space under the floor operates a three-way valve on the supply main to the heating coils. Supply steam to the special heat exchanger for that zone is controlled in the same manner as for any of the zones of that building.

Total Heating Load Is 12 Million Btu per Hr

The total heating load of the building is 12 million Btu per hr. The radiant heating load of the chapel is 150,000 Btu per hr and that of the reception hall 100,000 Btu per hr. The hot water panel system supplies 100 percent of the heating load of the chapel and 42 percent of the load of the reception hall.

Two large water tube boilers — each of 15 million Btu per hr capacity — produce saturated steam at 115 lb per hr and 350 F. A third boiler — 150 hp Scotch dry back — meets summer needs.

The boiler room is in a wing opposite the chapel wing. The heat exchangers for all zones are with the circulating pumps in a special room in the same wing, close to the boiler room. An ample supply of hot water is available from the heat exchangers at all times for the hot water heating system and other needs. Main feed lines are in tunnels, with many points of access for maintenance. Besides simplifying installation, this left ceiling areas free for electrical conduits and ventilation ducts.

Bunker C, heavy oil, No. 6 is the type of fuel oil burned. The fuel oil is preheated in the storage tank at 90 F and then in the oil heaters at 190 F. The oil storage tanks, installed in a special vault adjacent to the boiler room, include two 13,000 gal tanks and one 10,500 gal tank. The annual fuel requirement is estimated at 190,000 gal. Thus, at 10 cents per gal the annual heating cost is expected to be $19,000.

Provide for Future Air Conditioning

Aluminum ventilating ducts are installed throughout. There are ventilation supply units for the kitchen, laundry, and cafeteria. Exhaust fans are installed in all of the above mentioned rooms and also in interior spaces like the chapel, reception hall, dormitory, corridors, and toilets. Also, there are supply, exhaust, and recirculating units in the theater.

The fans for the various zones of the ventilating system are installed in penthouses. Main ducts are installed in central shafts. Space has been left for later installation of air conditioning units in the penthouses if these should be desired at any time.

In the theater and operating rooms, provision has been made for the future installation of air conditioning. All necessary ductwork has been installed. In the operating suite a dew point control type of system will be installed. A preheating coil will raise the temperature to 40 F above freezing. Then the dew point control will operate the steam and the face and bypass damper valve of the heating coil to bring the temperature of the outlet air of this coil to 55 F. The room thermostat will then operate the booster coil to raise the temperature of the air to the desired condition.

The general architects were Blatter & Caron. The special architect for the chapel was Berchmans Gagnon. The general contractor was Poudrier & Boulet. The mechanical (heating, piping, and air conditioning) contractor was J. B. Dugas, Inc. The ventilating contractor was Mobec, Ltd. ‡

Golden Age Predicted For International Trade

. . . in next 25 years

A GOLDEN AGE of international trade, unsurpassed in history, will develop within the next 25 years, says E. A. Meyerhofer, Swiss sales and engineering executive, and president, international branch of Trion, Inc.

"The causes will be : (1) the emergence of the once backward countries of the East and Near East as growing consumers of modern products; (2) an expanding European market to replace wartime obsolescence and destruction, and to meet demands for the newest conveniences of science; and (3) the rapid increases of populations throughout the world."

The Swiss executive expressed these sentiments at a reception given him at the Duquesne Club.

"Europe is now lagging behind the U. S. in air cleaning, television, refrigerators and other basic products of modern science due to wartime upheavals," he said. "But sales promotion and public education are beginning to close the gap.

"I believe that the expansion of world trade in this manner offers the best and perhaps the only stable road to peace." ‡

Sam Lewis' Page

Intemperate Design Cools Convectors

Excessively long horizontal finned tube convectors in a large air conditioning system must be replaced by shorter tubes because one-third of the convector face refuses to be warmed by steam entering from a vertical header.

EXPERIENCES during recent times again point to the desirability of exercising temperance. One medical researcher suggests that about 16 out of 100 social drinkers of alcohol, who fail to be temperate, eventually become drunkards. I have had several experiences with friends who were intemperate, and am a devoted supporter of Alcoholics Anonymous, but I am now thinking of temperance in the sense of engineering moderation. I have just been bumped expensively by some of the other fellow's lack of engineering temperance, and I remember some of my own in connection with steam heated convectors in ventilating systems.

Sixty years ago, the steam heating convectors used in ventilating systems were made of vertical steel pipes screwed into horizontal, cast iron, two compartment, base headers. These convectors worked fairly well, since the cored base castings inherently could not be made too long, and the vertical pipes rarely were so tall but that they became steam hot.

When, however, vacuum systems of circulation appeared and it was necessary to convert the old vertical pipe convectors, they would not get hot until we crawled under each section and drilled a hole through the lower compartment of the thick cast iron base, and through this hole drilled and tapped a smaller hole into the bottom of the upper compartment. We then connected an air and condensate pipe into the upper compartment, skillfully fitting a bushing around the condensate pipe into the larger hole through the bottom of the lower compartment. Then we installed a vacuum trap on the pipe, thus to vent and drain the upper compartment.

About 40 years ago the cast iron base and vertical steel pipe convectors commenced gradually to be superseded by sectional cored cast iron slabs that were connected side by side with threaded cast iron nipples. This type of convector has a long life but when employed without temperance as to size would not get hot all over, no matter how large we made the conventionally arranged vacuum traps and air valves.

I designed many blast steam heating systems with these cast iron convectors in the air stream induced by the fan and did not always exercise enough temperance. The steam inlet end and the tops of the slabs near the upper nipples would become warm, but a great proportion of the convector face would be trying to heat the fan propelled ventilating air with some objectionable fluid, probably a little steam, some unvented air and much undrained water.

I was compelled to install, in such cases, an interior air vent pipe usually $\frac{3}{4}$ in., extended through a $2\frac{1}{2}$ in. bushed tee at the alleged condensate outlet of each convector, so that this pipe could carry out to a separate vacuum trap, the too-cool fluid so that really hot steam might replace it. The open inner end of the inserted pipe would be about three-fourths of the way across the bottom of the assembled heater, diagonally opposite the steam inlet.

The hollow cast iron convectors and the $2\frac{1}{2}$ in. cast iron nipples have been superseded by heaters composed of relatively small horizontal tubes, each tube surrounded by fins between which the air from the fan shall be blown. This convector operates acceptably if the tube that carries the steam is relatively short, and if there is allowance for expansion of the tubes. However, the tube must not be so long that steam fails to heat it all the way. Designers of ventilating plants occasionally have made the convector tubes so very long that steam becomes condensed and arrives at the opposite end of the tube in the form of rather chilly water. It followed that the scheme of an interior pipe through the lower header of the heater was employed, not only to carry relatively hot steam to the remote area, but also to assist, as I did in the old days, in removing the entrained air and condensate.

Despite the interior steam distributing pipe however, we must improve a large air conditioning system that has long, horizontal, finned tube convectors. The plant was built with the steam to enter at the top of one end of a vertical header for the horizontal tubes and the condensate air outlet was at the bottom of this same header. About one-third of the convector face refuses to get warm and fails to do its duty. Physical conditions prohibit making an additional condensate vent connection at the bottom header opposite the steam supply pipe.

There was not enough temperance employed when such long convector tubes of such small diameter were installed. We now must remove them and must purchase new convectors. Each new tube will be half as long as the old ones, and there will be twice as many headers. ‡

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

OLD OFFICE BUILDING in heart of changing market area buys surplus brine from company supplying cold storage houses

Purchased Brine Cuts Cost of Air Conditioning Old Building

Low first cost and simplicity of operation were among the reasons this installation was designed to utilize zero degree brine for refrigeration effect. Special problems were selection of materials, prevention of freezing, and air distribution.

By F. J. Walsh
Consulting Engineer
Formerly Chief Air Conditioning Engineer
Mongitore & Moesel
Consulting Engineers

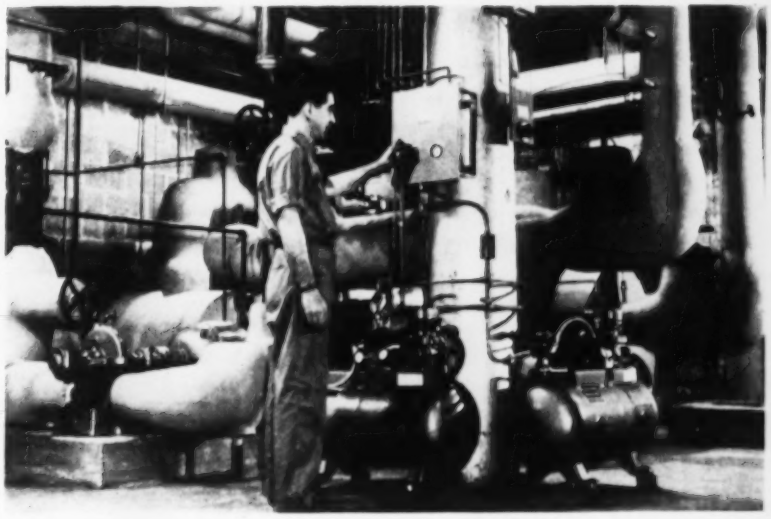
ZERO DEGREE BRINE distributed through underground mains provides refrigeration for the comfort air conditioning system in the American Express Co.'s 10 story building at 55 Hudson St., New York.

Since the turn of the century, there has existed a network of mains installed to supply zero degree brine to cold storage buildings in the downtown market area. Because the nature of the area has been gradually changing, more surplus refrigeration capacity is available now than in the past. While low temperature refrigeration such as this requires much greater compressor horsepower and much larger equipment than does refrigeration for air conditioning, it can be purchased for air conditioning installations at a price comparable with the cost of individually producing refrigeration for the latter.

The main American Express Co. offices at 65 Broadway had been air conditioned previously by means of a central chilled water refrigeration plant utilizing two turbine driven centrifugal compressors.

The building at 55 Hudson is an older structure, with floors suitable for either storage or office use, and as such could not justify any large expenditure for an air conditioning installation. Travelers' cheques which return from all parts of the world to the main office at 65 Broadway pass through a clearing operation and are trucked to the Hudson Street building for the complex sorting and filing operations involved in the accounting procedures. There are approximately 800 employees working in the 10 story structure. Eight floors and a basement lunch room were first air conditioned and capacity provided for the two upper floors, which recently were also air conditioned.

The decision to purchase brine service was recommended by the engineers only after a careful engineering economy study proved that it would be at least as economical in the long run as installing a separate refrigeration plant in the building. The considerable saving in first cost and simplicity of operation — no additional help being required — were the deciding factors.



SELECTING CONTROL, operator sets summer-winter switch. For air conditioning, secondary brine is cooled by primary brine in a shell and tube heat exchanger. In the heating season, secondary brine is heated by a converter using low pressure steam from the existing boiler plant to temper air supply

The complete installation has been operating for a year, with completely satisfactory results. Basically, the refrigeration effect for the air conditioning load is produced in a brine to brine heat exchanger. The primary brine is calcium chloride brine of 1.25 specific gravity, and the secondary brine is a 20 percent by weight solution of ethylene glycol, with suitable corrosion inhibitors. The secondary brine is pumped to the cooling coils of the air handling units on each floor to produce the actual cooling. The brine flow and control and measuring devices are diagrammed in the accompanying sketch on page 88.

From the 12 in. mains in the street, valved 6 in. branch lines enter the basement and connect with the air conditioning brine cooler adjacent to the existing boiler room. Sufficient pressure differential between the supply and return mains makes a booster pump unnecessary to circulate the zero degree brine — primary brine — through the cooler, valves, and piping.

In the brine cooler — a shell and tube heat exchanger of special design and construction — primary brine passes through the shell, and secondary brine — air conditioning brine — passes through the tubes. The cooler has a capacity of 300 tons of refrigeration when cooling the secondary brine from 53 F to 38 F, with the design quantity of zero degree primary brine passing through the shell of the cooler.

To maintain constant temperature of the secondary brine, a thermostat, in the secondary brine line leaving the cooler, controls two modulating valves in the primary brine supply lines at the cooler. On a call for cooling, the valve on the inlet to the cooler gradually opens and the valve in the bypass starts to close. The total flow of primary brine through the circuit is kept constant.

Control Prevents Freezing

Secondary brine is pumped through its circuit by means of two centrifugal pumps. The starting of these pumps monitors the operation of the automatic valves in the primary brine circuit and "starts" the system. In normal operation the pumps are started manually, but on shutdown one pump is arranged to start automatically, through the action of a low limit safety thermostat in the outlet of the cooler, if the temperature should drop too low due to leakage of primary brine into the cooler. The thermostat would also actuate an alarm bell to indicate abnormal conditions.

As an added safety feature, a timer keeps one pump running for about five minutes after the primary brine shutdown, so that the residual secondary brine is not pulled down low enough in temperature to ring the alarm bell.

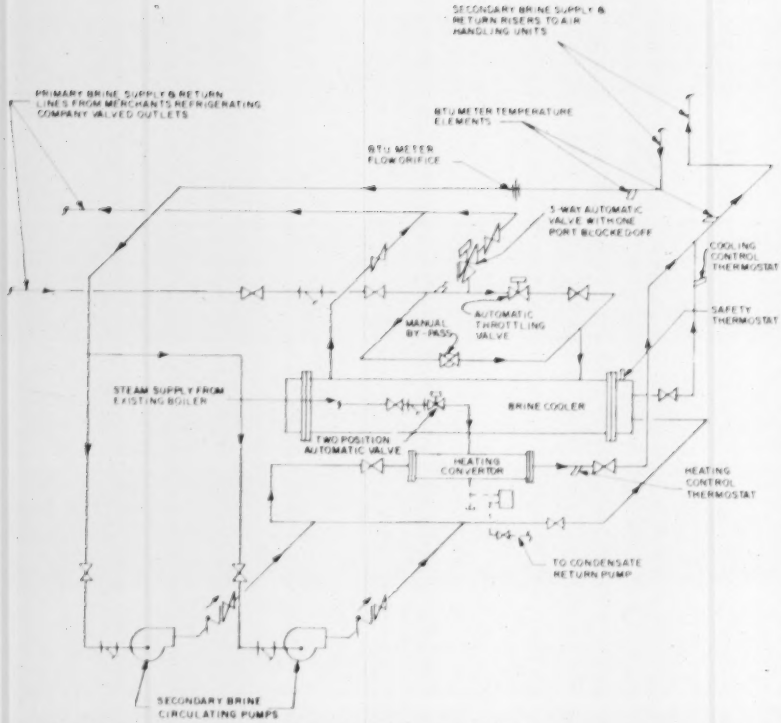
System Tempers Winter Air

In the heating season, the secondary brine is used to temper the air supply to the spaces. The brine is heated by means of a converter using low pressure steam from the existing boiler plant. When the building is shut down, one pump is started automatically if the outside temperature falls below 25 F, and a minimum brine temperature of 60 F is maintained.

The amount of refrigeration delivered is measured by a recording and totalizing Btu meter in the secondary brine circuit. Two 24 hr charts are used. One chart records secondary brine flow, lb per hr, and also inlet and outlet brine temperatures, F, at the cooler. The second chart records the rate at which refrigeration is being used, Btu per hr. A totalizing counter indicates total Btu used at any particular time. Monthly bills based on meter readings state charges in terms of ton-days of refrigeration used.

Solve Special Problems

The design of the system involved certain problems. For example, valves in the secondary brine system could


SECONDARY BRINE SUPPLY & RETURN RISERS TO AIR HANDLING UNITS
PRIMARY BRINE SUPPLY & RETURN LINES FROM MERCHANTS REFRIGERATING COMPANY VALVED OUTLETS
BTU METER TEMPERATURE ELEMENTS
BTU METER FLOW ORIFICE
3-WAY AUTOMATIC VALVE WITH ONE PORT BLOCKED OFF
COOLING CONTROL THERMOSTAT
SAFETY THERMOSTAT
AUTOMATIC THROTTLING VALVE
MANUAL BY-PASS
STEAM SUPPLY FROM EXISTING BOILER
BRINE COOLER
TWO POSITION AUTOMATIC VALVE
HEATING CONVERTOR
HEATING CONTROL THERMOSTAT
TO CONDENSATE RETURN PUMP
SECONDARY BRINE CIRCULATING PUMPS

HEATING AND COOLING CIRCUITS for primary and secondary brine include brine cooler and steam converter for seasonal cooling or heating of secondary brine which is pumped to the coils of the air handling units on each floor

not be standard iron body bronze mounted construction because the bronze could not be expected to stand up under the service intended, nor could normally selected materials be used in other parts of the system.

Another big problem was protection of the secondary brine against freezeup. Because the addition of too large a percent of ethylene glycol would have considerably reduced heat transfer both in the heat exchanger and in the cooling coils of the air handling units, this was kept to a minimum. The engineers were confident that with as little as 10 percent ethylene glycol in the system, the secondary brine could not freeze solid to the extent of tube rupture if safety controls failed, because this type brine starts to form a slush at what is commonly termed its freezing point, and does not freeze solid until a number of degrees below this point. Also, for the normal operating condition, any slush which tends to form will be washed right off the surface of the tube. However, to protect against sluggishness in starting up, it was decided to use a 20 percent by weight solution of ethylene glycol with a nominal freezing point of approximately 13 F.

Another problem was air distribution, because a simple layout of ductwork and diffusers was essential in order to keep installation costs down. Low ceiling heights, existing obstructions of various kinds, and other difficulties meant that conventional registers could not be used because the air drop due to temperature differential would be too great for any possible selection of registers. This problem was solved with a register with a high rate of secondary air entrainment at the register face.

Purchased brine service for air conditioning in this building has several important advantages:

- Low first cost of air conditioning installation.
- Minimum space requirements, noise, and vibration.
- Simplicity of operation.
- No licensed refrigeration engineer or other special help required.
- No condensing water required.

The major limitation to the extension of this service for air conditioning lies in the arrangement and size of the existing distribution mains and brine quantities required to serve existing customers along the network. The present cost of changing main sizes or extending existing mains in a downtown area for a particular customer would, in general, be prohibitive. ‡

Many Hotels Restudy Air Conditioning Plans

. . . survey discloses

ONLY 20 PERCENT of 1050 hotels with 100 or more guest rooms are now totally conditioned, according to a recent survey by the Anemostat Corp. of America. Fifty percent are partially conditioned, and the remainder are nonconditioned. Air conditioning in many partially conditioned hotels is confined to public spaces.

Lack of space to accommodate the large air ducts required in conventional air conditioning systems has been one of the chief problems, since most of the nation's major hotels were built before 1933 and no space was allowed for air conditioning units. Smaller ducts used in high velocity systems are causing many hotels to restudy the possibility of complete air conditioning, according to the survey. ‡

Corrosive Cloud Caused By Foreign Substance

. . . in chlorine cooler tube

FERRIC CHLORIDE SMOKE which drifted in a heavy, brown cloud toward the town of Montague, Mich., some time ago from the Hooker Electrochemical Co.'s nearby plant was caused by some foreign substance, possibly oil, in the tubing of a chlorine cooler, according to the company.

The accident occurred while cutting in a chlorine cooler which had just been retubed. A chemical reaction forming ferric chloride and causing local overheating in the tubing melted the pipe and released the gas. The situation was under control in about half an hour. ‡

The Law and Your Profits

By William Hurd Hillyer

"Extra Costs" Claims Make Poor Collection Bets in Court

EXTRA CHARGES in addition to those specified by contract may well bring one into court, where the probability of collecting is not too good. This applies, as we shall see in the first of two cases, even to charges considered customary. All the names are fictitious.

During a cold spell, Warren T. Deedholder telephoned the Heatwright Engineering Co. that the boiler in his business structure had failed to perform. He authorized Heatwright to replace it. The heating contractor later stated in court that he told Deedholder the cost of installation would not run over a certain figure if there were no "unforeseen circumstances." Deedholder assured him that this was the ordinary type of boiler replacement and that there would be no unforeseen circumstances to increase the cost. The building owner denied having made any such representation, when he appeared before the judge.

Heatwright's field superintendent testified that the old boiler had been set inside a ditch which had been dug in the earth under the building. Because it would have been "dangerous" to set the new boiler therein, he had his men construct a cement floor base for it. The superintendent described the difficulties in removing the old boiler and getting the new one through the building to ground level. He also testified as to the installation of certain extra items, such as an automatic feeder on which he said Deedholder insisted, a stack switch ordered installed by the owner's electrical contractor, and a safety switch required by the local building code.

The extras were not contemplated when the contractor estimated a maximum cost—by telephone—and constituted "unforeseen circumstances." Such extras were covered by a "reasonable" sum which he added to the original estimate. When payment was not forthcoming, Heatwright brought suit.

The trial judge held that, in effect, it was one man's word against another's. He agreed with Heatwright's claim that the "original price" for installation, labor and material was not meant to include "extras" or unforeseen expense. Furthermore, said the court, because Deedholder had been in the construction business for many years, he should have foreseen that the ordering and installation of extras would increase the total price.

Another of Deedholder's contentions had to do with the amount demanded. The inclusion of 10 percent for overhead and 10 percent for profit was improper, he protested. The judge found that the parties had established between themselves a practice of making such charges. Deedholder, when faced with judgment, laid his case before the court of appeals.

The court viewed the evidence in Heatwright's favor as "somewhat thin. All the record contains (on the point of previous practice) is a showing by an invoice that such a method of charging was pursued on a later occasion, when the contractual relationship was reversed and Deedholder's company "did some excavating and grading work" for Heatwright. This circumstance, the higher court found, "did not establish a firm and continuing practice;" nevertheless, "being uncontradicted and unexplained it did show" that Deedholder "recognized and approved that method of charging for work."

If the building owner had attacked what the appeals court called "thin" evidence, the scales of justice might have been tipped in his favor and the outcome of the case different.

The courts are inclined to construe strictly all "extra cost" contentions. In another recent decision, a subcontractor sued the general contractors for additional cost items allegedly due under agreement between parties. The subcontractor won a judgment in municipal court, but the general contractors appealed.

Reversing the lower court's decision, the appellate division held that the subcontractor, having failed to comply with the general contract provision requiring claim for "extra cost" to be made in writing before proceeding with work, was not entitled to recover for such "extra cost." "It has been uniformly held," the justices said, that "in the absence of conduct operating as a waiver or giving rise to an estoppal, failure to make a claim for extra cost in the manner and within the time specified precludes recovery therefor."

(Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.)

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

DOWNPOUR OR DRIZZLE can be regulated in any degree by manual adjustment of rheostat. Push another button and turn on a different kind of weather

A sunshiny shower:
Won't last half an hour.
Michael Denham

Pushbutton Weather Device Gives Nature a Hand for TV Shows

Rain, snow, hail, and fog are made to order by this "Rube Goldberg" creation that consists of a high pressure steam generator, refrigerating compressor, air ducts, flexible piping, two rows of spray nozzles, all mounted on a movable platform rigged above the stage.

A COMPACT MACHINE that creates rain, hail, snow, or fog on command demonstrates the moisture proof quality of various products advertised on NBC-TV's *Home* show.

Called the "Elementary" because it dispenses the elements, the specially constructed weather machine is a partially enclosed cage of steel pipe and sheet metal suspended 12 ft above the floor.

Installed on the "roof" of the machine are a refrigerating compressor, an air condenser, an electric steam generator, an ice scraper, and various controls.

Steam produced by the high pressure electric steam generator is stored in accumulators. At the same time, cold air is produced by refrigeration. When the steam is released and hits the cold air, it condenses into suspended moisture or fog.

When the fog device was tested, so little haze was produced that the steam pressure had to be almost doubled before it created the kind of fog a camera could photograph.

The "rain" piping coming off the existing cold water riser in the area had to be installed underneath the machine's casing to be concealed from the camera's eye. The water

piping was installed in the lip of the casing. The installation had to be braced so that it would stand up under heavy downpour.

When the director pushes a button calling for rain, he activates a manually adjusted, low voltage rheostat. This maintains remote control on a pressure regulating valve. The valve in turn controls the water pressure. If it is finely shut, the director gets a hazy drizzle. If it is wide open, he gets an April downpour. The water flows along water pipes and out through a series of ten dispersing nozzles on the bottom of the machine. The floor base is perforated and the water drains off into pipes beneath, so that there is no danger of flooding the studio stage.

After an early test run, workers had to mop up the studio floor for two hours. It took two nights of steady work, shortening the piping, regulating the supply rate, changing the spray heads and adjusting them, before the right kind of spray was achieved. The spray heads were changed six times.

Although the pipe fitters were able to use the engineer's blueprints for most of their job, some of the specifications created snags that had to be cleared up as work progressed. Creating a shower without spraying the rest of the stage was one of them.

ROBOT "CLOUD" in studio sky out of video range awaits signal to turn on the weather called for by the script

There are two sets of sprays — front and back — each with its own motorized valve coming off a single manifold. Thus, rain on only half of the stage can be arranged when an actor looks out of a window.

"Snow" is made by a rotary scraper flaking large cakes of ice into small crystals. These are fed into a cold air stream which is given turbulence by a high speed blower.

Flexible piping and hosing permit the "Elementary" to ride up and down from ceiling to stage easily in one operation by stage rigging. All of the piping and hosing used on the job is conventional material.

Design and construction required less than three months. Cort Mechanical Corp. designed the system. S. Gerber and Co. were the piping contractors. — S. Peker.

U.S. Government To Air Condition Most New Future Buildings

. . . under a new policy adopted by the General Services Administration. Here is a summary of the recommended standards for air conditioning and heating new government buildings.

Air Conditioning will be specified in most new U. S. government buildings such as office buildings, court houses, hospitals, and post offices — according to the General Services Administration. In addition, heating and ventilation and other standards are being upgraded to bring all mechanical services in line with good commercial practice. The new policy is the result of a study of GSA documents, criteria, and practices that

establish design and construction standards.

The new standards call for air conditioning basically in those regions of the U. S. where the effective temperature is 80 F or higher for a prolonged period of summer heat.

Among some of the factors are increased lighting intensities and the necessity to get more usable space in "block type" buildings recommended for future construction. Interior spaces—more than 16 or 18 ft from the windows—require ventilation and room air temperatures between 76 and 78 F in summer, with a relative humidity of about 45 percent, and 71 to 75 F in winter, with a relative humidity of about 35 percent, for occupants to be comfortable and unaware of the air conditions, says the GSA.

For hospitals, the new policy takes note of the common practice today to install air conditioning—except in a few states of the Northwest where the outside relative humidity in summer never exceeds 65 percent—in operating, recovery, delivery, and labor rooms, and in many cases in nurses' work rooms and central sterile supply rooms. Being air conditioned, too, are research laboratories, animal rooms, x-rays, and other facilities in large hospitals so equipped.

Patients' rooms should also be air conditioned as a measure for speedier recovery, the GSA feels, where the outside wet bulb temperature exceeds 67 F for 55 percent of the summer. Many patients will wait, if possible, until summer is over, rather than go into a non-air conditioned hospital during hot weather, thus reducing full usage of the available beds.

If money is short, the working parts of the air conditioning systems, such as ducts, piping, fans and cooling units and all other builtin equipment should be installed at the time of construction, leaving the refrigerating plant to be installed later, says the GSA.

In the case of post offices, traditional high ceilings will increase the cost of air conditioning. If post office authorities can devise some method of inspection and supervision permitting lower ceiling heights, initial costs of air conditioning installations will be reduced. In that case, post offices—except in the very small communities—would fall into the same 80 F effective temperature category recommended.

Government buildings up to now have been designed with "conventional systems" for interior spaces, with separate peripheral systems—some with low and some with high velocity units. Conventional systems for interior spaces have been based upon duct velocities not exceeding 1600 fpm.

In future construction, however, some systems will be designed using ducts with air velocities up to 4000 fpm. One important factor is that smaller ducts, taking less shaft area and shallower ceiling depth, save building space. Where temperature requirements of interior spaces vary because of different types of lighting and occupancy loads, warm and cold air double duct systems have been installed, permitting automatic temperature variation and adjustment to varying room requirements.

In large buildings, high velocity methods of duct distribution will be given serious consideration.

Radiant cooling will not be recommended for government buildings "until it is more competitive in cost than it is today."

Heating of government buildings, with a few minor exceptions, is generally in accord with present day practice. Standards that were recommended, practically all of which have long been the practice of the GSA Public Buildings Service, are the following:

1) Adequate furnace volumes in boilers, especially with stoker fired soft coal or oil burners.

2) Insulation on vertical steel boiler stacks, where these are located in shafts inside the building, to prevent hot walls adjacent to the shaft.

3) Adequate outside air inlets to boiler room for combustion; size of such inlet to be at least as large as the area of the stack.

4) Carefully insulated ceilings to prevent hot floors above boiler rooms containing large high or low pressure boilers or rooms containing the reducing valves on incoming high pressure steam mains. Also provide adequate ventilation; outside air for combustion or ventilation should be forced through the space above the insulating ceilings and into the boiler room.

5) Separate zoning for each face of non-air conditioned buildings heated with steam radiators or convectors. Provide zone control; valved orifice plates installed in radiator inlet valves; and inside-outside temperature control, for better and more economical heating.

6) Concealed risers and radiator branches of extra heavy pipe, if steel or wrought iron, to insure longer life; concealed return piping of brass pipe or copper tubing of proper weight.

7) In buildings taller than three stories, all risers should be valved, and all upfeed steam risers should be dripped.

8) Each low pressure steam boiler should be provided with an automatic water feeder; and if the fuel is fired automatically in stoker or oil burner, the water feeder should also be provided with a low water cutout.

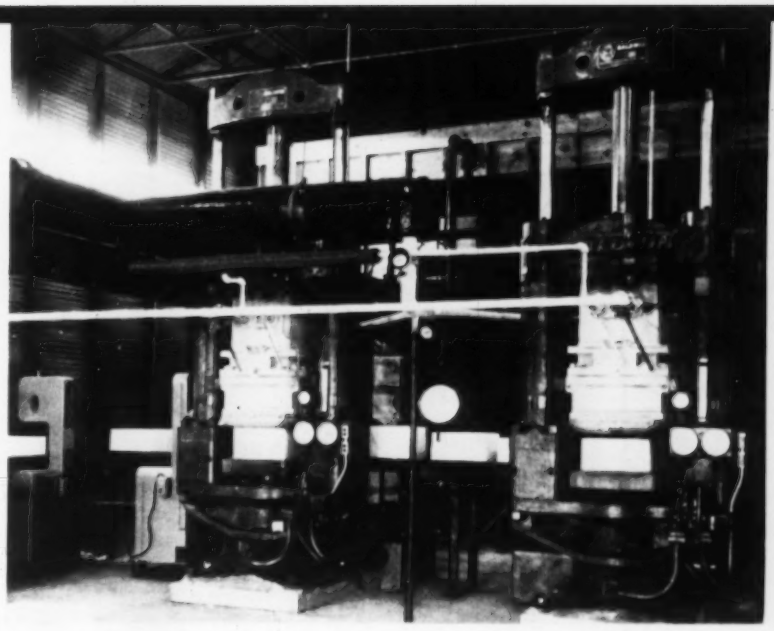
9) The damper in each oil fired boiler breeching should have an opening therein equal to 20 percent of the free area of the breeching.

10) Tunnels containing steam mains should have gravity vents for tunnel ventilation and avoid overheating.

11) All steam piping must be designed for adequate expansion, whether in risers of tall buildings, long horizontal mains in basements, or in tunnels. Expansion joints must be provided where necessary, or preferably expansion loops. Care must be taken with hangers of all piping subject to expansion.

12) Radiant heating should be provided for ramps located where snow or ice can cause skidding of trucks thereon. For large buildings snow melting should be considered for sidewalks or entrances.

Radiant heating for non-air conditioned buildings is not recommended now "because installation techniques have not yet been developed to the point where this form of heating is competitive in first cost with steam heating." +



COMPRESSED BLOCKS OF DRY ICE are made when subcooled CO_2 upon expansion into the snow press chambers, flashes into loose snow, which is then compressed by lowering the ram. Flash gas is drawn back into the system through suction lines insulated with molded cork. Piping is supported by hangers from steel frames of the roof

Pipe Natural CO_2 to Dry Ice Plant

. . . through 8 in. pipe line five miles long. In plant, most of the ammonia and CO_2 piping and vessels — of varying weights — is of welded steel construction, with welding neck flanges at many points.

AN 8 IN. PIPE LINE, five miles long, brings carbon dioxide gas from natural wells in the desert of Southeastern Colorado to the Colorado CO_2 Corp. plant, where it is changed to solid form in quantities up to 50 tons a day, according to the Frick Co.

Pumped from the wells into the pipe line by a booster compressor, the gas enters the mixing drum at the plant at an average pressure of 25 psig. The temperature in the mixer and exchanger is lowered by the cold gases returning from the snow presses. Some of the entrained moisture is removed by this procedure.

The gas is drawn from the mixer into a pair of standard 12 in. × 12 in. enclosed type compressors, each with two cylinders. These are equipped with automatic capacity controls, hydraulically operated. The machines discharge at 250 psig pressure into a water cooled shell and tube vessel, which serves as a precooler and oil separator. The gas then moves to four vertical oil filters, having removable heads, with the piping so arranged that they can be operated in parallel groups or in a series. The cleaned carbon dioxide is then changed to liquid form in a shell and tube condenser. This vessel is also vertical and has in the tubes liquid ammonia maintained at − 28 F. The liquefied carbon dioxide is stored in a 38 in. × 13 ft receiver.

After leaving the receiver the liquid stream goes into a single-pass heat exchanger through which the blowback gas from the snow machines is drawn on its way to the mixer. The carbon dioxide condenser, the receiver, and the subcoolers are normally covered with frost and are enclosed in an insulated room.

The ammonia cycle includes two large compressors, each with four cylinders of size 14 × 12 in. These handle the suction gas from the system which cools the CO_2 condenser. The ammonia is condensed in an eight-pass shell and tube vessel supplied with water from a cooling tower. The liquid ammonia drains into a receiver 24 in. in diameter × 13 ft long. This is fitted with an electric purger.

Both the ammonia and carbon dioxide systems are protected by high and low pressure cutouts with alarm bells and similar safety devices, including a new type of high capacity safety valve.

The majority of the heavy piping, as well as the shell vessels, are of welded steel construction, in accordance with the ASME Code for unfired pressure vessels.

The heavy piping uses welding neck flanges at many points. The ammonia and carbon dioxide lines 1½ in. in diameter and over are welded, while the smaller lines have screwed fittings. The water lines 2 in. in diameter and above are welded, others screwed, using galvanized pipe.

The lines carrying either carbon dioxide or ammonia at pressures of 250 lb are extra heavy pipe in sizes ¼ in. through 2½ in. Larger gas and refrigerant lines are full weight. The piping is supported by hangers extending downward from the steel frames of the roof. The suction lines are insulated with standard molded cork.

Question of the Month

How Should Steam Valves Be Sized?

THE QUESTION *How Should Steam Valves Be Sized?*, was asked previously in HPAC and is repeated here along with answers that have been received from readers. Other answers for publication will also be welcome.

"A commonly used rule of thumb for sizing low pressure — under 15 psig — modulating steam valves, is to use a pressure drop through the valve of from 40 to 60 percent of the line pressure just ahead of the valve.

"For higher pressures than 15 psig, the rule says the drop should be 25 to 35 percent of line pressure. This second rule has been questioned, with the statement that modulating valves on higher pressures, say from 20 to 100 psig, should be sized for a greater pressure drop than valves on low pressure lines.

"The rule further says that positive acting — two-position — steam valves should be sized for pressure drops 25 to 50 percent lower than those given above.

"Another rule of thumb for modulating water valves, including three-way mixing valves, says that these valves should be sized for a drop of from 5 to 15 percent of the line pressure ahead of valve. This, when the valve is on the inlet side of a heating or cooling coil. When the valve is on the outlet side of a coil, the pressure drop may be increased by 25 to 50 percent.

"There is much variation of opinion on this subject, and I would like to hear what other engineers have to say about this. I believe that HPAC can clarify the situation by publishing these comments." F.A.R.

• *IF YOU DON'T HAVE the answer to a heating, piping or air conditioning problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

D. N. CROSTHWAIT—

Size Valves on Basis of Flow Conditions to Exist

VALVES have been sized for steam service on the basis of assumed pressure drops for many years. On such a basis the usual procedure is to consider that the drop of pressure differential through the valve will be a percentage of the initial gage pressure. For example, if the supply pressure was 2.0 psig, a drop of 1.0 psi might be used; or if 5.0 psig, a drop of 2.0 psi. Thus, the percentage ranged 40 to 50 percent.

During the time this practice became quite general, the valves used for controlling were essentially globe valves with a sliding instead of a screwed stem, operated by a hand wheel, and arranged to be power operated by means giving sliding action. The intention was to obtain control by varying the lift, but the "lift-flow" characteristics of the valve were not a matter of great concern. Often the valves were installed to provide automatic opening and closing to maintain or provide some control of temperature. A principal concern was to be certain the valve would provide the maximum steam demand and give a degree of control or modulation action through variation of the supply pressure, usually obtained by regulating the combustion. Steam valves sized on such a basis resulted in ratios of the final to the supply pressure which exceeded 0.58, so variation in the supply pressure resulted in variation in the steam flow — a regulation or control requisite.

"Modulating valves," so-called, were first introduced into the technology in connection with certain proprietary steam heating systems. They were proposed to permit better control of and distribution of steam to the radiation. In operation, these systems were presumed to maintain the steam supply steadily at the stated pressure, usually 1 to 2 psig. Control of the radiators was by varying the steam supply to them by opening the valve a greater or lesser extent in accord with the heating effect wanted.

The inner valve construction was of special design to permit varying the flow area with greater accuracy than obtainable from other valves which were, as to their inner valve and seat construction, the equivalent of the globe valves. Automatically operated valves, positioned to varying degrees of opening by the action of the controlling thermostat, have come to be referred to as "modulating valves." Such reference now implies a rather good degree of control. Desirable performance seeks the needed variation in steam flow as the controlled condition requires, but without objectionable noise levels from high velocity flow. It is important that valves which are to modulate should not be oversized, since if the greatest flow requirements are satisfied when the valve is only partially opened, further opening will not have any effect on the flow of the steam, as is evident.

Although the so-called "rules of thumb" are satisfactory for sizing valves for many conditions and as a guide for limiting values, it is considered preferable to size valves on the basis of the flow conditions which are to exist. Better results may be expected from valves selected on the basis of as accurate a value of the pressure drop as is obtainable and — wherever possible — the actual drop.

Valve manufacturers have available extensive capacity data for a wide range of pressure drops or differentials. If the drop is accurately known, valves selected may be to the needed degree of precision. — D. N. CROSTHWAIT, Technical Adviser, C. A. Dunham Co.

H. B. WAYNE—

Size Varies Directly With Flow Coefficient

A BRIEF REVIEW of fluid flow principles will show that allowable pressure drop across a modulating type valve is governed by system requirements and is not dependent upon upstream pressure only. Frequently the allowable pressure drop is dictated by process requirements when the upstream and downstream pressures and line losses are established. If pressure drop is introduced into the system for control purposes, selecting an exact value for pressure drop is arbitrary. A frequently used rule employs approximately 50 percent of the system friction loss exclusive of the valve, or about one-third of the total pressure loss including the valve. It is not feasible to have less than 5 to 10 psig pressure drop for most applications. It is important not to allow increased friction in the piping system reduce valve control ability that may result from higher flow rates and/or reduction of flow area due to fouling of the piping.

Since cost of a control valve varies with size, many engineers tend to select a unit that has limited capacity. Therefore a distinction should be made between design and maximum flow rates.

To take care of such contingencies, an allowance of 25 to 60 percent of the design flow rate should be added to assure that the valve will operate within the specified control limits. This margin is also recommended to care for possible future increased flow rates resulting from process changes.

If the process flow is subjected to wide load variations requiring the valve to control from near open to near closed position, it is necessary to determine if these requirements can be satisfied by the valve design characteristics. When sizing the valve, not only should maximum flow rate and corresponding minimum pressure drop be considered, but minimum flow rate and accompanying maximum pressure drop also.

The relations between flow rate, pressure drop and control valve size for water and steam services are given by the following.

For water:

$$C_v = Q\sqrt{G}/\sqrt{P_1 - P_2}$$

For saturated steam having a pressure drop across the valve less than one-half the absolute inlet pressure:

$$C_v = W/3\sqrt{(p_1 - p_2)p_2}$$

For superheated steam having a pressure drop across the valve less than one-half the absolute inlet pressure:

$$C_v = WK/3\sqrt{(p_1 - p_2)p_2}$$

For saturated steam having a pressure drop across the valve equal to or greater than one-half the absolute inlet pressure:

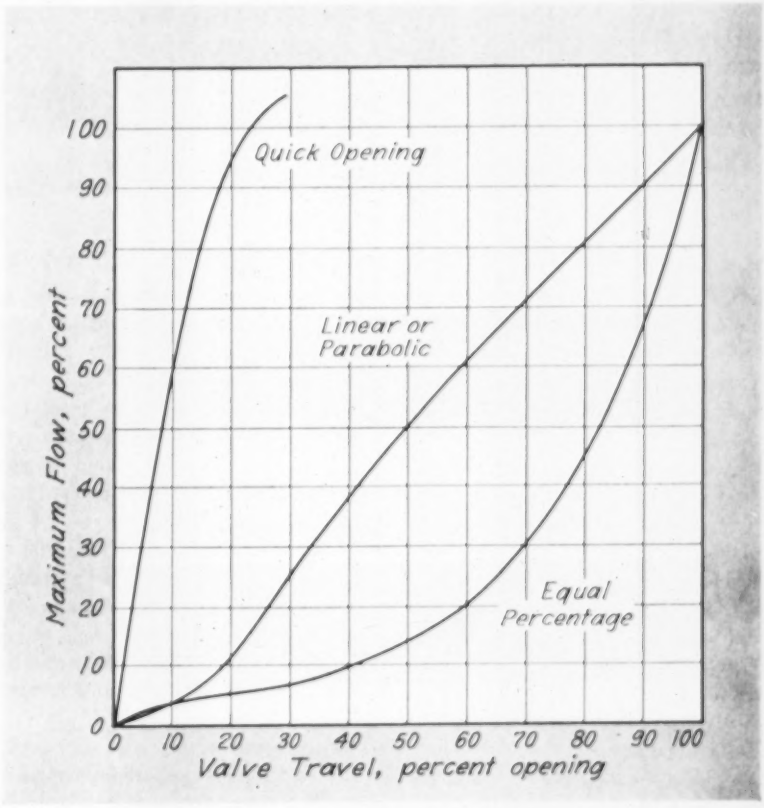
$$C_v = W/1.5p_2$$

For superheated steam having a pressure drop across the valve equal to or greater than one-half the absolute inlet pressure:

$$C_v = WK/1.5p_2$$

where: C_v = valve flow coefficient; Q = Water flow rate, gpm; G = Specific gravity of water; P_1 = Water flow valve inlet pressure, psig; P_2 = Water valve outlet pressure, psig; W = Steam flow rate, lb per hr; p_1 = Water valve inlet pressure, psia; p_2 = Steam valve outlet pressure, psia; and K = 1 + (0.0007 × deg F superheat).

The valve capacity or flow coefficient C_v is defined as the gpm of water at 60 F temperature that will flow through a fully opened valve with a pressure drop of 1 psi. As an example: a flow coefficient of 30 means 1 psi pressure drop will allow 30 gpm to pass through the valve when fully opened. Valve size varies directly with the value of the flow coefficient. From the above formulas it may be seen that a high pressure



FLOW RATE is a function of a valve stem opening as shown here for different types of valve plugs

drop will allow use of a small valve as shown by the following tabulation:

C_v	Diameter, in.
1.0	5/16
1.6	¼
2.5	⅜
4.0	½
6.5	¾
10.0	1
16.0	1¼
25.0	1½
40.0	2
65.0	2½
100.0	3
160.0	4
360.0	6
640.0	8
1000.0	10
1440.0	12

A control valve that is too large, will stroke only a short part of its available travel. The attached graph is a plot showng relation of flow rate as a function of valve stem position for different types of valve plugs. If pressure drop in the piping system is greater than that for the valve, the equal percentage type plug is preferred. If line pressure loss is nearly constant with varying flow rate, the linear or parabolic type plug will better meet these requirements. The quick acting plug gives full opening for short stem travel. This design does not possess good throttling characteristics and is used for on-off control applications, or for linear flow performance where constant pressure conditions prevail. — H. B. WAYNE, Consulting Engineer. ✣

READER ASKS—

"What's Causing Compressors To Fail?"

"THREE 30 ton air conditioning units on the 11th floor are used to cool the first floor and basement restaurant by a circulating pump from the units at the compressor.

"Last spring and summer, every week or 10 days some of the suction discs in the compressors would break, so we installed new rings and an oil separator on the discharge line. We also blew out the system to get rid of any oil in the lines. This seemed to help for a while. Then when more load was put on the zone in question, the pulleys on the motors to the compressors were changed to speed them up, suction valve discs began breaking again.

"The compressors are installed for automatic operation, with two thermostatic expansion valves and two solenoid valves. Two new 50 ton thermostatic valves were installed last winter, but with the compressors not in operation yet this season, we don't know if that was the trouble.

"We operate on a temperature of 10 F to the circulating pumps and the suction pressure is 28 in. Hg. The head pressure is 120 psi. An outside evaporator and fan which are water cooled are on the roof.

"We would appreciate any help and advice HPAC readers would be kind enough to send us as to what is causing these failures." — S. C. M.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Must Plan Now to Meet Needs of 1966, 1976

. . . industrialist looks ahead

THE LONG TERM implications of the U.S.'s growing population, rising standard of living, and rapidly advancing technology must be constantly reviewed by business and industry if the nation's future needs are to be met adequately, according to Ralph J. Cordiner, president of General Electric.

Speaking before the Economic Club of New York recently, he urged business leaders to free themselves of this year's plans and programs and look at least 10 years ahead. "The mounting problems and opportunities are making even a decade a short space of time for planning. More and more we should be planning 15 or 20 years ahead — an entire business generation," he said.

Mr. Cordiner asserted that businessmen continue to underestimate in their long term projections. "And in assessing the immediate outlook," he said, "we too often seem to be astonished at the realization of even our more conservative projections."

He pointed out that the nation will reach a population of 169 million this year, nine years ahead of the forecast date. It is quite possible, he added, that current forecasts of slightly more than 190 million people in 1966 should be revised upward by some 10 million.

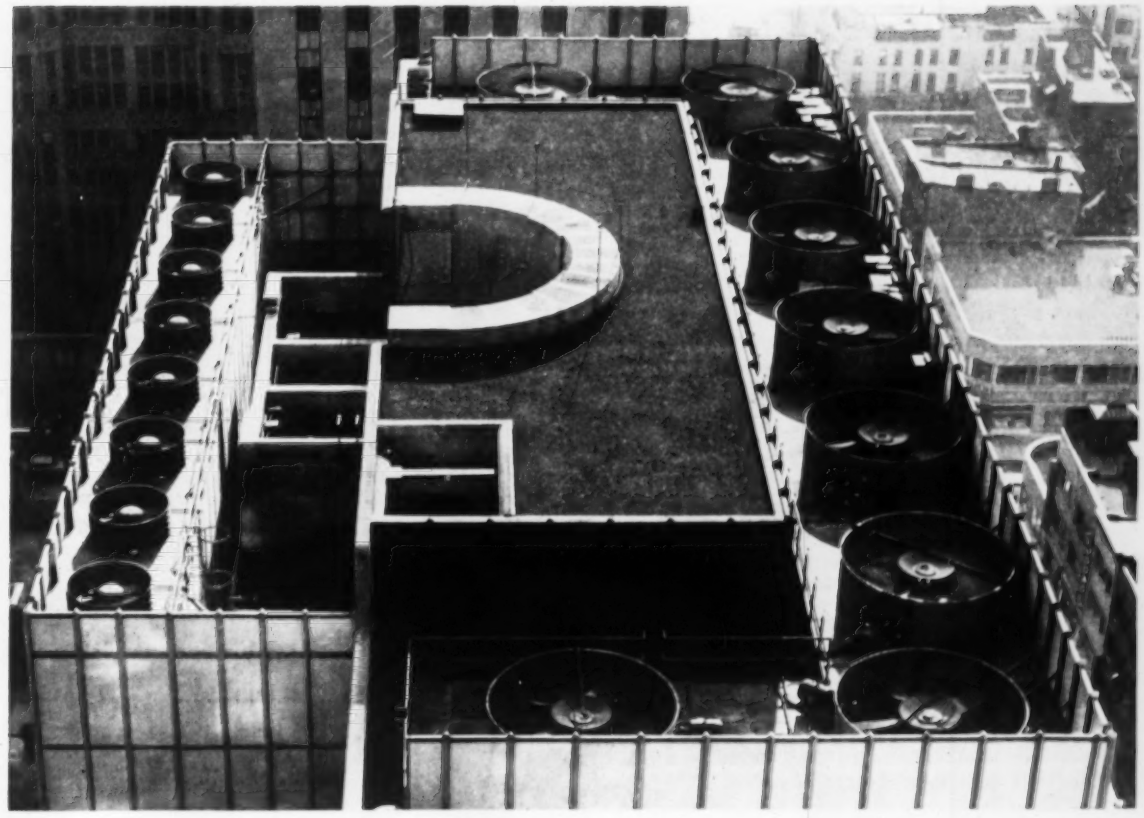
"We cannot wait until the 1960's if we are to have in place in time the manufacturing and commercial facilities, the homes, the transportation, highways, schools, and hospitals required to fill the needs of a nation of 200 million," he said.

This phenomenal population growth will be more than matched by the increase in our standard of living, Mr. Cordiner said. Referring to estimates of a gross national product of $535 billion by 1965, he commented, "Our own estimate would now be $550 billion in 1965 at 1955 prices, or approximately $570 billion by 1966.

"Between 1950 and 1954 the number of families with incomes of over $4000 a year after taxes increased from 12.2 million to 21.4 million. As productivity increases, bringing higher pay for higher skills, this trend is accelerating," he said.

For example, he said that average annual earnings of General Electric employees, including benefits, increased from about $2000 in 1939 to about $5600 in 1955 and may reach $8000 to $9000 a year by 1956.

The third major growth factor, Mr. Cordiner said, is the nation's rapidly expanding technology, resulting directly from private industry's growing investment in research and development. This investment, now more than $5 billion a year, "may well be our best insurance for stability in our future growth," he said. ✣



WHAT TO DO WHEN

Water Changes Its Mind

. . . from being corrosive in cooling tower makeup to being scale forming in air conditioning condensers

By Frederick S. Hodgdon
Carrier Corp.

Scale and corrosion can be prevented when the changing character of water is understood and its behavior predicted accurately. Recognition of (1) high pH and elevated temperature as the major factors causing scaling and (2) dissolved gases as the main causes of corrosion is only the beginning. In addition, accurate chemical analyses of the water and control of equilibrium conditions in the system are necessary.

The water conditioning program recommended here includes (1) proportional feeding of complex phosphates to makeup water, with bleedoff, to prevent scaling; (2) the addition of phosphates, nitrites, or chromates to the cooling tower water to prevent corrosion; and (3) the use of chlorine gas, sodium hypochlorite, or chlorinated phenols for algae and slime.

SCALE AND CORROSION of condensing equipment as results of improper water treatment cause some of the most serious problems with air conditioning today. Another troublesome condition frequently encountered is algae and slime formation.

As far as the layman is concerned, these problems occur because of the unpredictable character of water. Even the ancient Romans might be said to have recognized this unpredictability when they assigned the feminine gender to their word *aqua*.

A good example of how water can change its mind is shown in a large air conditioning installation using cooling towers. The potable water supply piping, which carried water for cooling tower makeup was failing frequently because of severe corrosion. The potable water had a low pH of 6.5, slightly acid, low total alkalinity, of 42 ppm as $CaCO_3$, low calcium of 4 ppm as $CaCO_3$, and a high 26 ppm amount of free CO_2. Such water would be classified as corrosive and would give every reason to expect rapid failure of makeup water piping.

Yet, at the same time, the condensers of all equipment using water from the cooling tower scaled rapidly and required several acid cleanings a year. The cooling tower water had a comparatively high pH of 8.0, a high alkalinity of 230 ppm as $CaCO_3$, and only 3 ppm of free CO_2.

Also, there were 11 cycles of concentration. This means that the dissolved minerals in the makeup water had concentrated about 11 times in the cooling tower water. At 11 cycles of concentration the alkalinity should have been 462 ppm and the calcium 44 ppm. Their respective values of 230 ppm and 22 ppm are the result of scale formation which removed some of these constituents from the water.

This water, classified as scale forming, would indicate scaling of condensers. It is not wise, therefore, to jump to conclusions about the behavior of water.

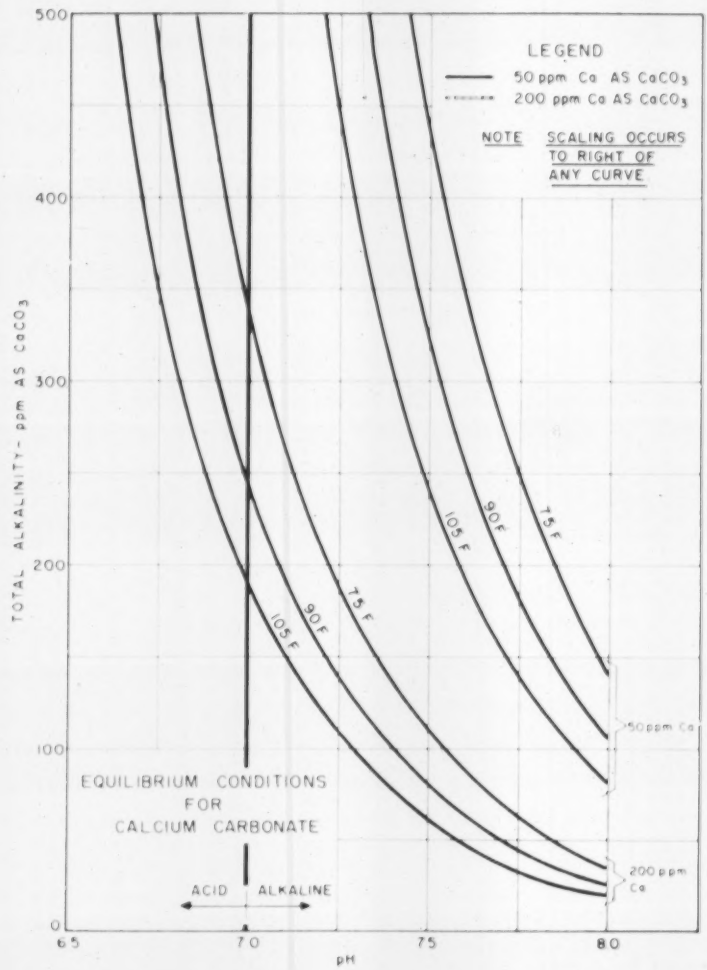
The behavior of most waters can be predicted accurately by a specialist. Once an accurate prediction

Continued on p. 100

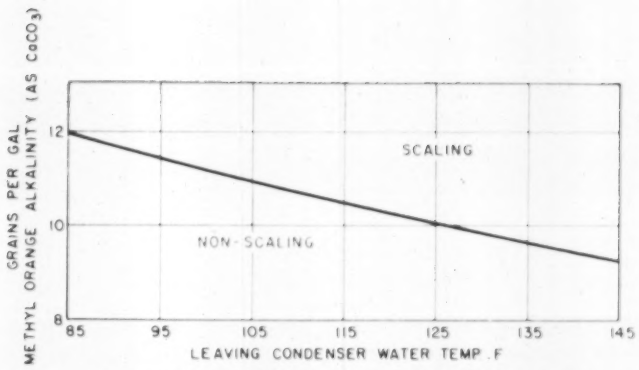
MAJOR FACTORS AFFECTING SCALING AND CORROSION

SCALING Dissolved Minerals		CORROSION Dissolved Gases	
ALKALINITY		O_2	(Oxygen)
Ca	$(HCO_3)_2$ (Calcium Bicarbonate)	CO_2	(Carbon Dioxide)
Mg	$(HCO_3)_2$ (Magnesium Bicarbonate)	SO_2	(Sulfur Dioxide)
Na	HCO_3 (Sodium Bicarbonate)	H_2S	(Hydrogen Sulfide)
HARDNESS			
Ca	$(HCO_3)_2$ (Calcium Bicarbonate)		
Ca	SO_4 (Calcium Sulfate)		
pH			
TEMPERATURE			

1 THE MAJOR FACTORS causing scaling and corrosion are shown here. The higher the amounts for each, the more serious the problem

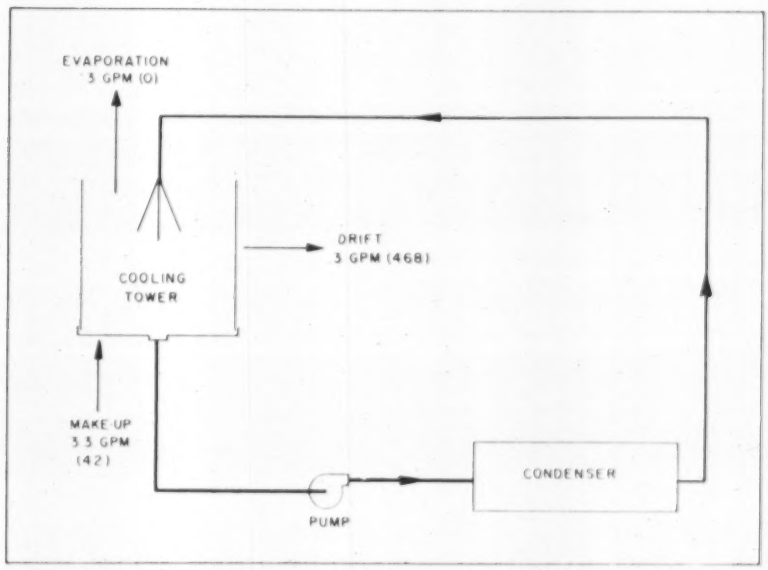


2 SCALING MAY BE PREDICTED if the character of the water is to the right of any of these curves. Corrosion is seen to result from sufficient decreases in pH, alkalinity, or temperature



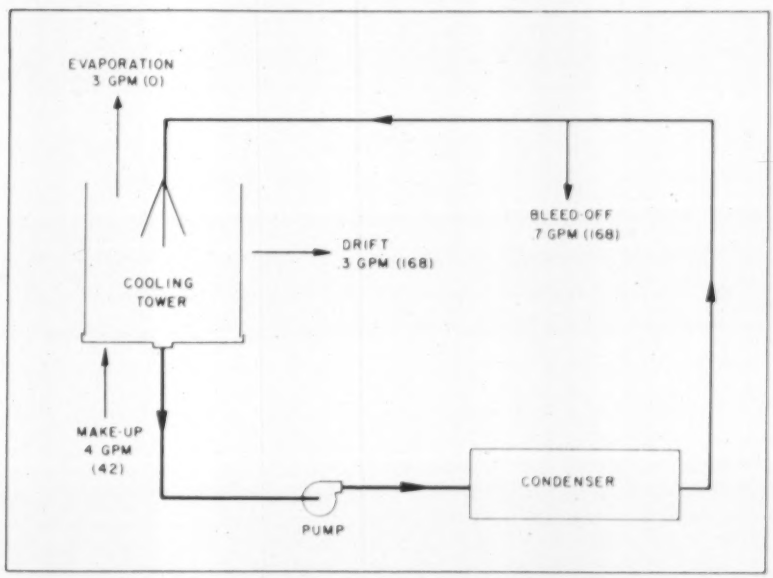
MAXIMUM ALLOWABLE METHYL ORANGE ALKALINITY
(WITHOUT CHEMICAL TREATMENT)

3 SIMPLIFIED PREDICTION of the scale forming characteristics of a water is based here on only alkalinity and temperature



CONDENSER WATER SYSTEM WITHOUT BLEED-OFF

4 DRIFT LOSS of cooling tower water has an alkaline concentration equal to that of the recirculating water, thus limiting the concentration of alkalinity



CONDENSER WATER SYSTEM WITH BLEED-OFF

5 CONTINUOUS BLEEDOFF can prevent scale formation in many cases without the use of chemicals, by limiting the alkalinity in the cooling tower water to about 10 grains per gal

has been made, it is possible to prevent scale and corrosion by relatively inexpensive means. The major factors affecting scale and corrosion are shown in Fig. 1. For most waters, scale is caused by bicarbonate alkalinity, calcium hardness, pH and temperature. The higher the numerical values for each of these factors, the greater the tendency for scale.

On the other hand, corrosion is caused primarily by dissolved gases. The greater the amount of dissolved gases, the more serious the corrosion.

In general, the greater the scaling tendency, the less the corrosive tendency, and vice versa. Since it is possible to determine the exact balance between these two tendencies, it is possible to predict the behavior of the water.

How To Predict Scaling

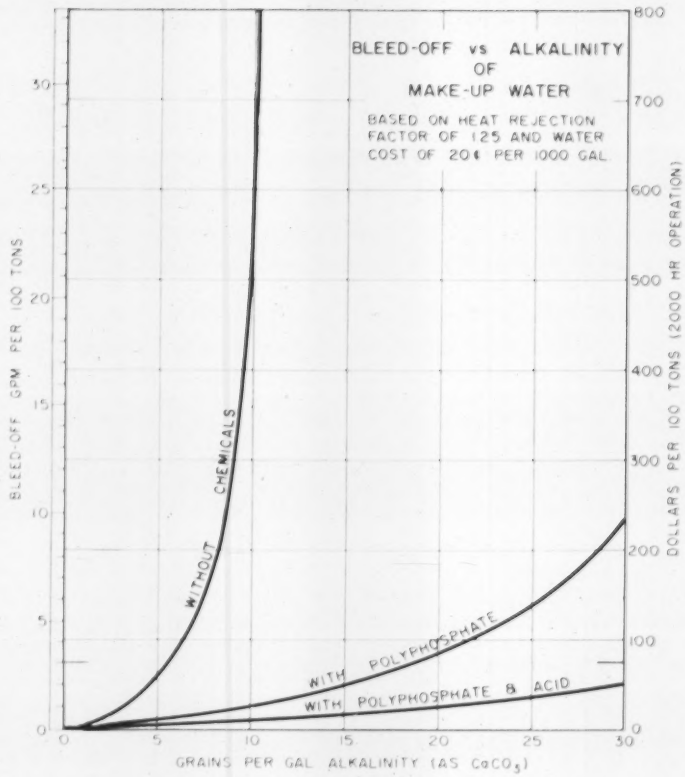
The scaling tendency of two waters, one having 50 ppm of calcium and the other 200 ppm of calcium, is shown in Fig. 2. The makeup water, which is slightly acid, low in alkalinity, and high in dissolved CO_2, falls to the left of both sets of curves, and is thus corrosive, not scale forming.

The cooling tower water, however, falls far to the right of the curves, and is therefore scale forming. Because this water should have 44 ppm of calcium because of concentration, the 50 ppm calcium curves can be used; the alkalinity should be 163 ppm. Both these figures are to the right of the curves.

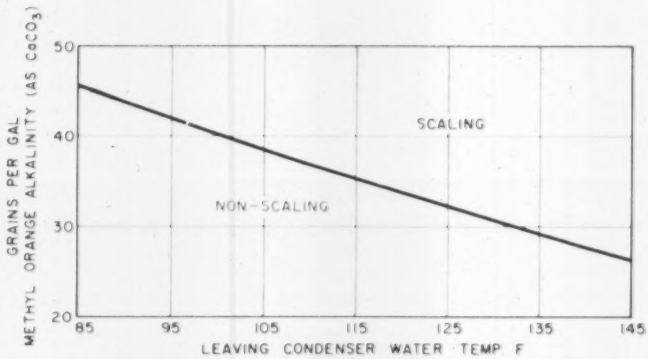
Increasing pH, calcium, alkalinity, or temperature promotes scale, as shown in Fig. 2. Conversely, decreasing pH, calcium, alkalinity, or temperature reduces scale, thus promoting corrosion.

Predicting the scale forming characteristics of most waters can be simplified as shown in Fig. 3. This prediction is based only on alkalinity and temperature. For example, at 105 F a water containing 10 grains per gal alkalinity would be nonscaling, while a water containing

. . . polyphosphates, with bleedoff,


BLEED-OFF vs ALKALINITY
OF
MAKE-UP WATER
BASED ON HEAT REJECTION FACTOR OF 1.25 AND WATER COST OF 20¢ PER 1000 GAL
BLEED-OFF GPM PER 100 TONS
DOLLARS PER 100 TONS (2000 HR OPERATION)
WITHOUT CHEMICALS
WITH POLYPHOSPHATE
WITH POLYPHOSPHATE & ACID
GRAINS PER GAL ALKALINITY (AS $CaCO_3$)

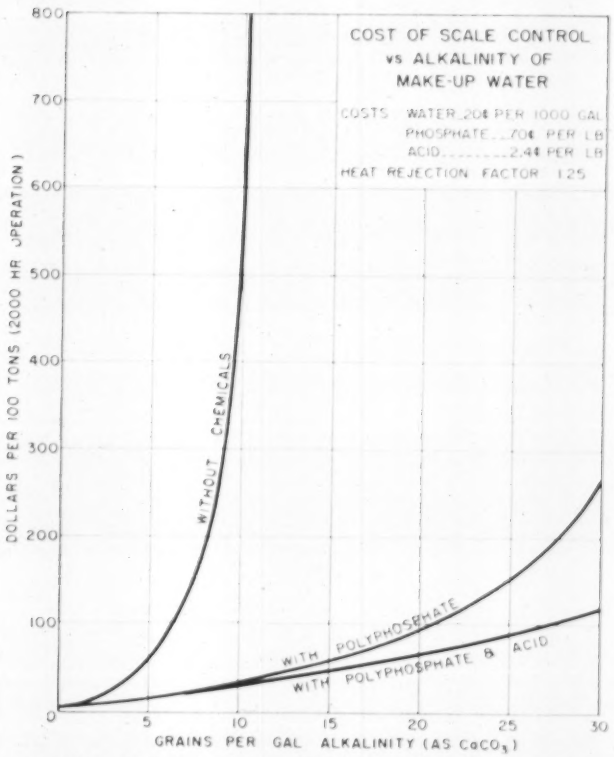
6 ALKALINE CONCENTRATION higher than 10 grains per gal in makeup — are permissible without scaling if polyphosphate is used with bleedoff. Bleedoff alone is impractical above 10 grains



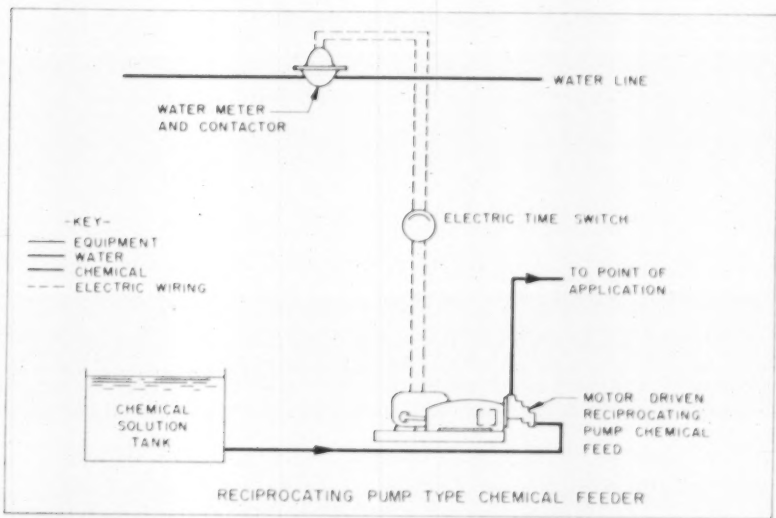
EFFECTIVENESS OF POLYPHOSPHATES-ONCE THROUGH SYSTEMS

7 EFFECTIVENESS OF POLYPHOSPHATES in controlling scaling in once through systems is shown here, based on the simplified prediction scheme of alkalinity vs. temperature

limit alkalinity to 10 grains per gal



8 THE COST OF SCALE CONTROL vs. alkalinity is shown here in dollars per 100 tons of cooling for 2000 hours



9 PROPORTIONAL FEEDING by a reciprocating type pump maintains the correct concentration of polyphosphate to prevent scaling. Acid which may be added to the water to further reduce bleedoff must also be fed proportionally

12 grains per gal would scale.

These predictions are valid regardless of whether water is used in a once through system or in a cooling tower system. The concentration and temperature apply to the water actually used in the condenser. However, because the alkalinity is concentrated in the cooling tower water, a water which is non-scale forming in a once through system can — and usually does — scale in a cooling tower system.

Drift Loss Limits Alkalinity

The concentration effect is illustrated in Fig. 4. A typical cooling tower has two sources of water loss.

(1) Evaporation of pure water to satisfy the cooling loads. This water removes no alkalinity.

(2) Drift loss. This limits the concentration of alkalinity, which mathematically, but not chemically, could be infinite if there were no drift loss. The concentration of alkalinity in the drift loss equals the concentration in the recirculating water.

The makeup water equals the sum of drift loss and evaporation. A makeup of 3.3 gpm is required in this case. It contains 42 ppm — 2.5 grains per gal — alkalinity and is non-scale forming. The drift loss contains 468 ppm — 27 grains per gal — and is scale forming. Thus, a non-scale forming water becomes scale forming.

Bleedoff Can Prevent Scaling

To prevent scaling, it is necessary to limit the alkalinity in the cooling tower water to about 10 grains per gal. In Fig. 5 the concentration of alkalinity is limited to 168 ppm — 9.8 grains per gal — when a continuous bleedoff is provided, 0.7 gpm in this case. Thus, in many cases, scale formation can be prevented without the use of chemicals. Bleedoff is all that is required.

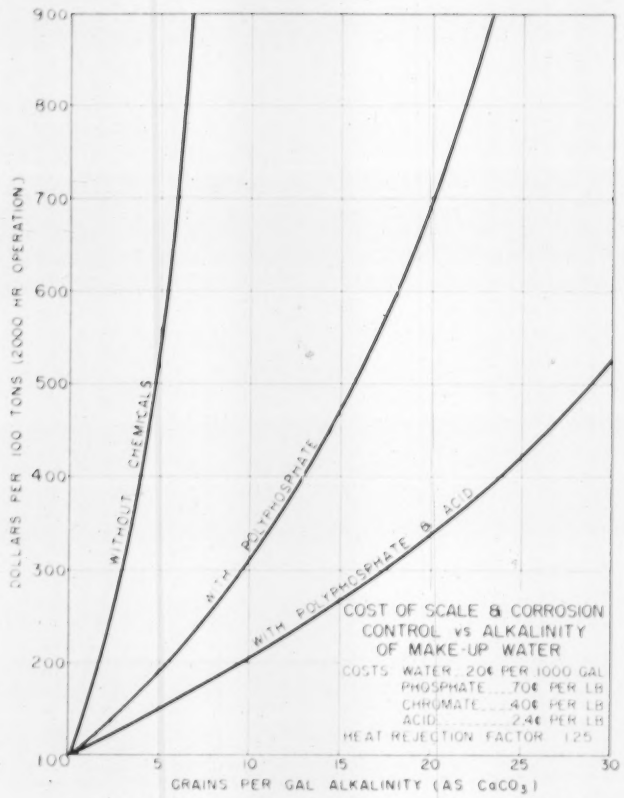
However, as the alkalinity of the makeup water approaches 10 grains per gal — see Fig. 6 — the amount of bleedoff becomes impractical. Much higher concentrations of alkalinity are permissible if a chemical

known as a complex phosphate or polyphosphate is used. (See Fig. 7.) Only 5 lb of a complex phosphate per 120,000 gal of makeup water are needed to obtain this benefit. Waters containing very large concentrations of alkalinity can be successfully used for cooling tower makeup without danger of scaling. (See Fig. 6.)

The cost of scale control, as shown in Fig. 8, is quite reasonable.

If a polyphosphate is used for scale control, bleedoff is required. Also, the chemical must be introduced in proportion to the makeup water. A proportional feeder, highly desirable from the standpoint of maintaining the correct concentration of polyphosphate, is shown in Fig. 9. Cases are known where insufficient and excess amounts of polyphosphate have caused scaling to occur.

Bleedoff can be further reduced by adding acid to the water. The acid must be fed with a proportional feeder and controlled with an automatic pH controller. Acid feeding without control has caused serious corrosion of piping and condensers. In addition, it poses a serious danger to operating personnel when not handled carefully.



10 COMPLETE COST of scale and corrosion control, a function of the alkalinity of the makeup water, is shown for three different methods

Use a Corrosion Inhibitor

As stated above, a water which is not scale forming will be corrosive. Therefore, cooling tower water which is not scale forming will cause corrosion of metals in the system. This corrosion can be especially serious because cooling tower water is saturated with dissolved oxygen. It is desirable, therefore, to use a corrosion inhibitor which will protect the metals against aggressive oxygen attack.

There are several corrosion inhibitors, such as chromates, nitrites, and phosphates — in order of increasing effectiveness — which are in common use for cooling towers. These inhibitors form very thin films — 0.000002 in. — which prevent oxygen in water from contacting the metals.

Chromates, while being more expensive than the others, give the optimum protection when used at concentrations of 300 to 500 ppm — 0.03 to 0.05 percent. The proportional feeder used for scale control is also used for feeding chromates.

Chromates have certain disadvantages. Yellow colored, they can cause staining. They are also toxic. There have been a few cases where chromates could not be used because the drift loss caused staining of adjacent property. In spite of this objection, chromates are widely used because staining and toxicity problems are infrequent.

The approximate cost of complete scale and corrosion control is shown in Fig. 10. This cost is a function of the alkalinity of the makeup water and of the method used to control scale.

Controlling Algae and Slime

The formation of algae and slime growths, another problem, is generally kept under control by the use of chlorine gas, sodium hypochlorite or chlorinated phenols. The use of copper sulfate and mercury compounds is not considered good practice. In fact, copper sulfate will precipitate as copper chromate or copper hydroxide in most cooling towers. This precipitation removes copper from the water and none is left to keep algae and slime under control. Also, copper and mercury compounds can be corrosive to metals in the system.

Consult Specialist for Program

In some cases, the prescribing of adequate water conditioning may be more complex than this discussion indicates. However, a good water conditioning program must include consideration of scale control, corrosion control, and algae and slime control.

As a final suggestion, the services of a competent water conditioning company or chemist are recommended before a water conditioning program is undertaken. ≠

Since this article was written, the author has joined the Metropolitan Refining Co., Inc., water treatment specialists, as Associate Chief Engineer.

TURNPIKE PLAZAS provide air conditioned facilities for dining, relaxation, and auto service

Air Condition Plazas Along Ohio Turnpike

. . . with three-zone central package systems

MORE THAN 700 TONS of air conditioning will add to the comfort of travelers along the new 241 mile Ohio turnpike, according to Acme Industries, Inc. At 16 modern service plazas a chilled water central system is coupled with a forced air distribution system.

Fully automatic, the equipment is in service 24 hr a day, seven days a week.

The layout and size of each building lent themselves to three separate cooling zones: the main dining area, the counter and lobby area, and the service station area. Each has a separate package water chiller, a separate air duct system, and its own temperature and electrical controls.

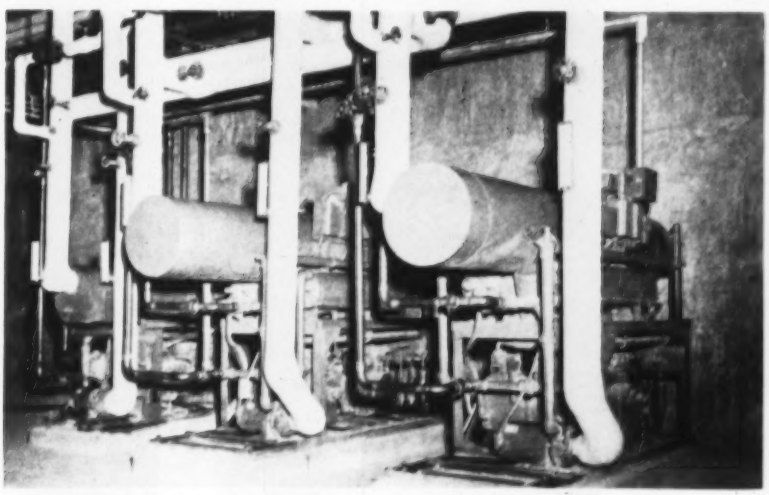
In 11 of the plazas, two of the chillers each have two 7½ ton compressors and one ¾ hp pump, while the third unit has one 7½ ton compressor and a ½ hp pump.

Chilled water is pumped through coils of factory built air handling units in the attic. Air is blown over these coils, through the duct system, and discharged into the plaza proper through ceiling diffusers. The dining area and the counter area are served by two separate 4500 cfm squirrel cage blowers. The service station has its own 2600 cfm blower. A large amount of intake air is required to compensate for the air drawn out through the kitchen's exhaust system.

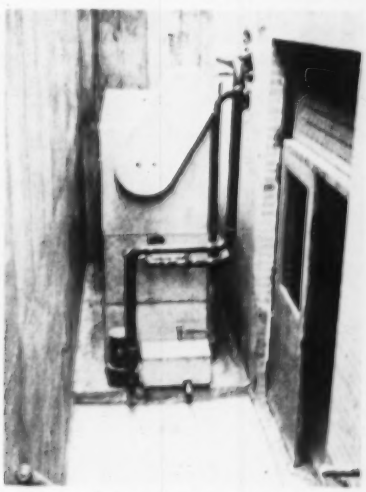
To conserve water — each plaza relies solely on its own wells — a 55 ton cooling tower cools the condensing water from all three liquid chillers. It is installed in an outside stairwell at the back of the building. Makeup water requirements have proved to be exceedingly low, running at less than 5 percent for all three units.

The duct system is used only for circulation of chilled air. Heat is furnished by two 60 hp oil fired boilers connected to a forced hot water system with extended convector finned radiation.

Heating and air conditioning contractors were: T. O. Murphy Co., Kaighin & Hughes, Inc., and Commercial Piping Co.



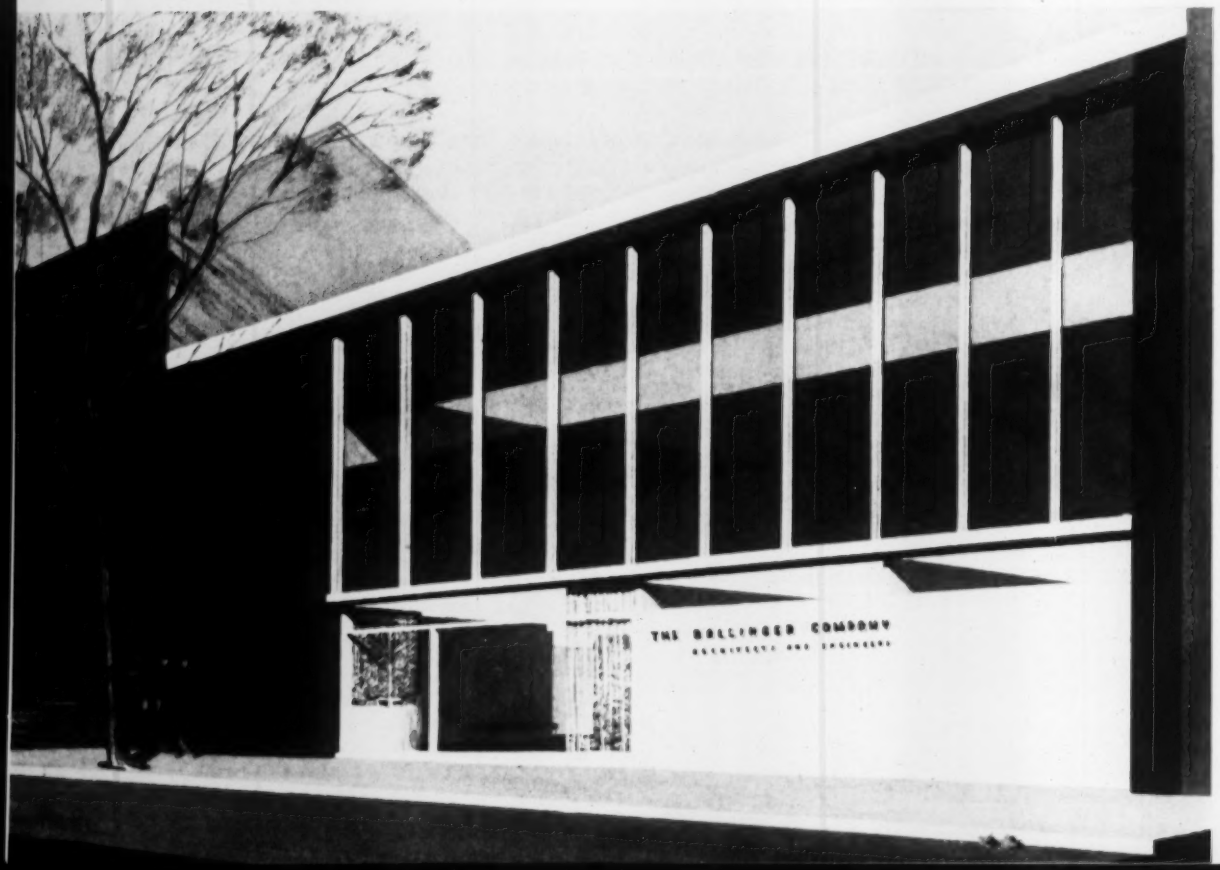
WATER CHILLING PLANT consists of three separate 7½ ton package compressors, one for each zone



55 TON COOLING TOWER in stairwell conserves well water. Makeup is less than 5 percent

FIRST APPLICATION of the compound compression heat pump system was in this recently opened department store. All cooling and heating equipment is in a penthouse on the roof.

FUTURE HOME of the Ballinger Co., architectural and engineering firm, this two-story, 15,840 sq ft building will be air conditioned year 'round by the new compound compression heat pump system

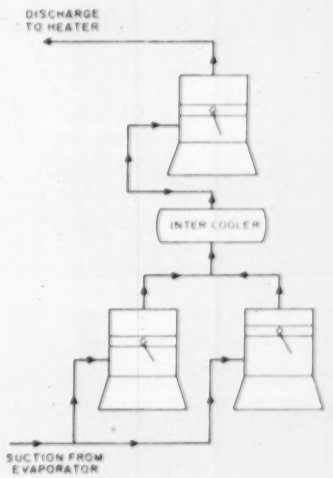


Below Freezing Air Yields Heat In New Heat Pump Systems

. . . in two new buildings. A single refrigeration system in each provides year 'round heating and cooling by means of the compound compression principle. By using this principle, enough heat can be removed from the outdoor air for heating these new buildings without the need for supplemental heating.

The new heat pump applies the principle of reverse cycle refrigeration operating in stages. The compressors are switched automatically from single stage compression into compound compression when the outdoor air drops below a certain point.

The heat removed by the refrigerant from outdoor air may be used to produce hot water, which can be circulated throughout the building, or the hot refrigerant can be used directly in coils to provide forced warm air heating.



COMPOUND COMPRESSION, illustrated here, is used in the new heat pump systems in two new buildings discussed in this article. Outdoor air is used as the heat source and the second stage is brought into operation just as soon as the outdoor temperature drops below a certain point. Thus, increased heating capacity is available when the heating load is increased.

THE FIRST application of a new heat pump, which utilizes outdoor air as the heat source and operates on the compound compression principle, is presently functioning in the new Heironimus department store in Roanoke, Va. Another installation is being made in a new office building in Philadelphia which is to be the home office of the Ballinger Co., architect and engineering firm.

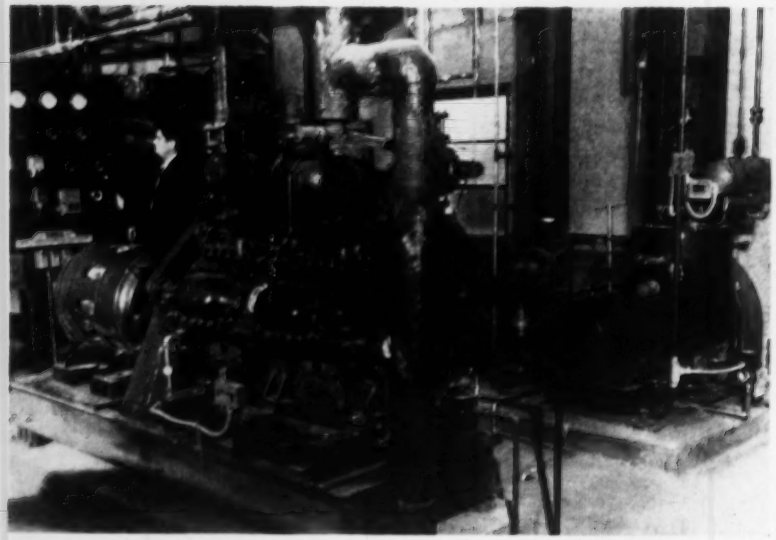
The economic aspects of this new development in the heat pump should lead to broad applications in many new buildings, said Ray K. Serfass, vice president of the York Corp. and general manager of its industrial division, in a recent meeting.

The type of installation in these two buildings makes use of a long known refrigeration technique—compound compression—which has been used for years to achieve economically the extremely low temperatures used in ice cream plants and the frozen food industry. With this principle utilized in the heat pump systems in these two new buildings, the need for supplemental heating has been removed.

The compound compression principle was applied to the air source heat pump for the first time by Robert C. Werden, a York Corp. sales engineering executive.

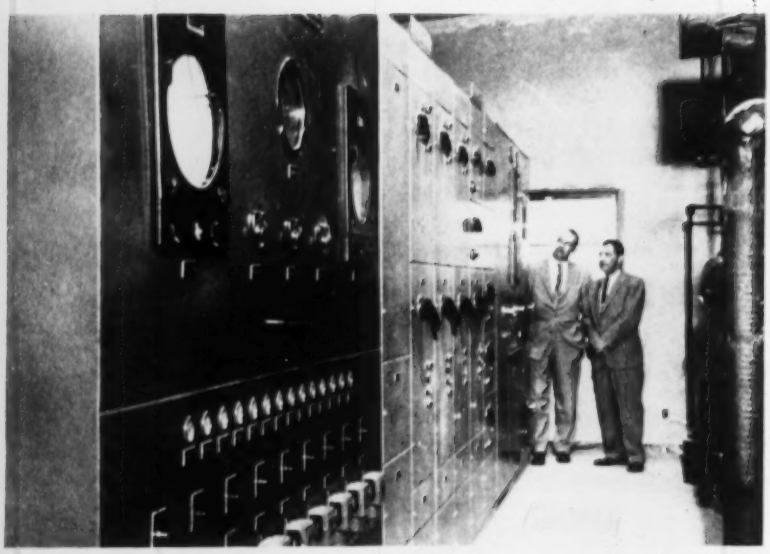
The heat pump can remove heat from zero F outside air while cooling this air to still lower temperatures as it passes over specially designed coils. The heat removed by the refrigerant from the outside air, is elevated to a usable temperature level by the compression cycle. Thermostatically controlled valves guide the hot or cold water flowing in and out of the system while the compressors automatically move from single stage compression to compound compression when the temperature drops below a certain point. This heat can be used to produce hot water, which can be circulated throughout the building in an indirect system, or the hot refrigerant can be used directly in coils to provide forced warm air heating through either a central unit or multiple units.

During warm weather, conversely, the expansion, or cooling of the refrigerant as it turns from liquid to gas, extracts heat from the water circulated through the refrigerant. The resulting chilled water is piped to the same coils and cools air blown through these coils.



NINE STEP COMPRESSION is provided by three compound compression heat pump systems in the Heironimus department store. System shown includes reciprocating compressor, foreground, and rotary low stage compressor, right. Each system has its own gage board, left

EVAPORATIVE CONDENSERS in summer, these six units on the department store roof act as air coolers in winter. During below freezing weather, specially designed refrigerant coils inside these units cool the frigid air to still lower temperatures, extracting heat



AUTOMATIC CONTROLS handle all climatic situations for the new compound compression heat pump system. Panel here is in the Heironimus department store, Roanoke, Va.

• 525 hp system conditions new department store

THE NEW $1\frac{3}{4}$ million S. H. Heironimus department store, Roanoke, Va., is air conditioned year 'round by a $\$1\frac{1}{4}$ million heat pump system.

The 525 hp heat pump system automatically filters the air every 10 or 12 minutes while keeping the temperature on each of the four floors and mezzanine at the desired level.

During the "in-between" periods of the year, different portions of the building can be simultaneously heated or cooled.

The cooling load is 312 tons, and the heating load is 2,450,000 Btu per hr at the design outdoor temperature of zero F.

The heat pump system is controlled by an outside master controller which resets either the inside chilled water or hot water submaster controllers, which in turn are connected to flow control valves that determine the amount of hot or chilled water to be supplied to the fan-coil units. An automatic seasonal changeover switches the cycles.

For winter heating, the hot water temperature increases proportionately with the decrease in outdoor temperature. There are nine steps in capacity increase as the outdoor temperature decreases in winter. The reciprocating compressors each have two steps and the rotary compressors have one step. Compressors serve the nine steps as follows:

Step 1: 50 percent of Reciprocating No. 1.

Step 2: 50 percent of Reciprocating Nos. 1 and 2.

Step 3: 50 percent of Reciprocating Nos. 1, 2, and 3.

Step 4: 100 percent of Reciprocating No. 1, 50 percent of Nos. 2 and 3.

Step 5: 100 percent of Reciprocating Nos. 1 and 2 and 50 percent of No. 3.

Step 6: 100 percent of Reciprocating Nos. 1, 2, and 3.

Step 7: 100 percent of Reciprocating Nos. 1, 2, and 3 and Rotary No. 1.

Step 8: 100 percent of Reciprocating Nos. 1, 2, and 3 and Rotary Nos. 1 and 2.

Step 9: 100 percent of Reciprocating Nos. 1, 2, and 3 and Rotary Nos. 1, 2, and 3.

Air is conditioned by 11 chilled or hot water fan-coil air units in the store. They are either floor or ceiling type, depending upon the area served. Air is delivered through conventional ducts to ceiling or sidewall diffusers.

The size of the store is 150×170 ft. It is comprised of four floors, a mezzanine, and a basement.

The factors considered in selecting the system were:

1: Low first cost.

2: Low operating cost.

3: Space saving features.

All heating and air conditioning equipment is mounted on the roof, leaving the basement free for use.

Architects and engineers for the Heironimus store were Hayes, Seay, Mattern, & Mattern, of Roanoke, Va.

• 120 hp system conditions new office building

A HOME OFFICE building to be completed this month in downtown Philadelphia, for the Ballinger Co., one of the nation's oldest firm of architects and engineers, will also be heated and air conditioned by this new type of heat pump system.

Also, heat absorbent glass will extend from the ceiling of the first story to the top edge of the roof and vertically across the spandrel floor construction of the contemporary two-story structure. Affording 15,840 sq ft of space—7420 sq ft on each level and 1000 sq ft partial basement—the totally enclosed structure will be 140 ×53 ft.

The heat pump equipment will be installed in the partial basement.

The first story will be conditioned by an 8400 cfm air handling unit connected to diffuser type outlets through conventional ductwork. Private offices will be independently treated by floor mounted fan-coil room units equipped with combination hot and chilled water coils.

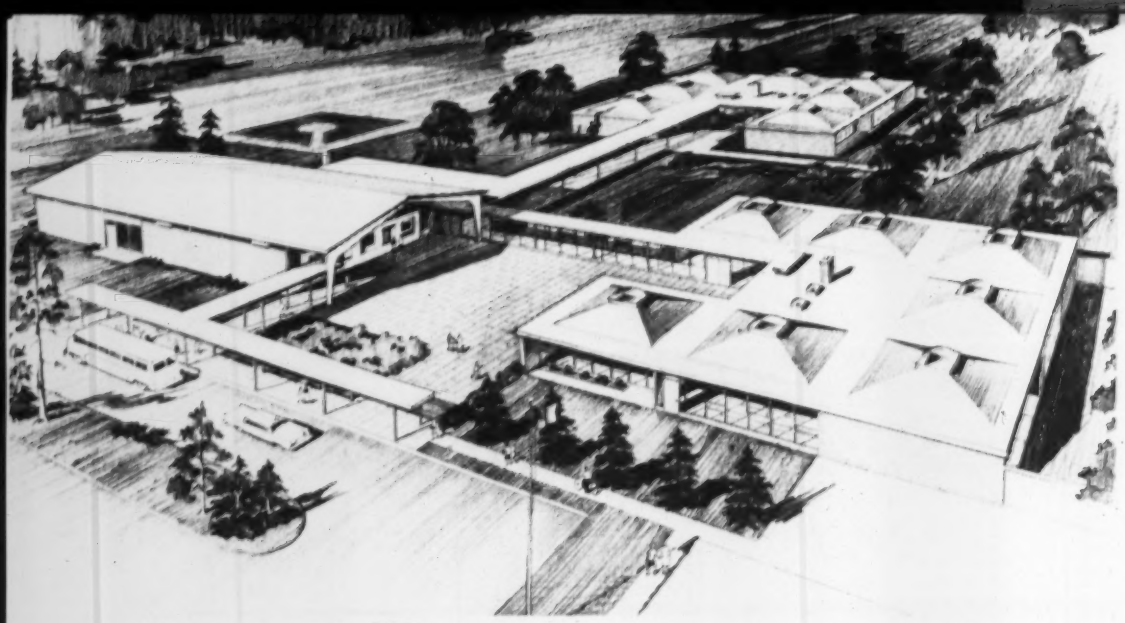
The second story will be conditioned by two air handling units of 8450 cfm and 3960 cfm respectively, each serving a separate zone.

During the cooling season, 45 F water will be circulated to the various air handling units by means of two 3 hp centrifugal pumps having a capacity of 70 gpm each. Water will be cooled to the desired temperature by refrigeration equipment consisting of a 60 ton multicylinder reciprocating compressor connected to a shell and tube water chiller of the flooded type and an evaporative condenser on the roof of the building.

During the heating season, hot water at 115 F will be circulated to the units. For the reverse refrigeration cycle, a duplicate reciprocating compressor will operate as the low stage of a two-stage compression system. Through suitable piping, the evaporative condenser on the roof will act as an evaporator extracting the required heat from the outdoor air by lowering the temperature from zero F to −20 F. The shell and tube chiller will perform as a condenser, releasing the heat removed from the outdoor air plus the heat of compression.

In winter, the north and south walls will receive supplemental heating to offset downdrafts utilizing underwindow duct systems with vertical air discharge of floor mounted fan-coil type room units equipped with hot water heating coils.

The system will be pneumatically controlled. Changeover from cooling to heating will be accomplished by means of a summer-winter switch which will automatically position valves and reverse the operation of thermostats so that the required refrigerant flow and sequence of operation will be obtained.



THREE SEPARATE BUILDINGS form elementary school now under construction. State's strict ventilation requirements and slab on grade construction necessitating warm floors resulted in choice of separate direct fired units with duct systems in each building

Forced Warm Air Heats New School

Three building units joined by passages include an all purpose unit, and two identical 10,000 sq ft clusters of seven classrooms. Each unit is heated by a central direct fired heater. Radial supply ducts, buried 2 in. in concrete, warm slab floors as they deliver filtered, tempered, and humidified air to each room through perimeter diffusers. Return air is exhausted through back to back closets. Thermostats provide individual room control.

By Fred S. Dubin
Fred S. Dubin Associates
Consulting Engineers

THE West Bridgewater, Mass., elementary school now under construction consists of three separate buildings joined by passages, one of which is enclosed and heated, the other open and unheated but covered by a roof. Two of the buildings are identical, each consisting of approximately 10,000 sq ft, including seven classrooms in a cluster, toilet rooms, a small lobby and assembly space, and a heater room and custodian's storage space. The third building contains the all purpose room which will be used for games, general school assemblies, and cafeteria, a kitchen, administrative offices, nurse and dental offices, and a short corridor.

Financial Budget "Tight"

Faced with a "tight" financial budget, the engineers were given the following conditions to meet in the design of the heating and ventilating system:

The Massachusetts department of public safety required $2\frac{1}{2}$ cfm of outdoor air per square foot of floor space in the all purpose room; 15 cfm of outdoor air and 30 cfm of total air circulated for each of the 130 pupils; positive exhaust ventilation from each classroom, all purpose room and toilet rooms; and positive wardrobe exhaust.

Each classroom was to have individual temperature control.

There was to be air filtration, humidification, and a means of cooling classrooms.

The slab on grade construction of the building necessitated providing for warm floors.

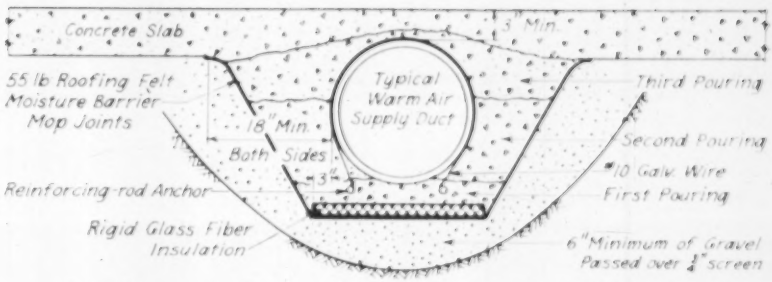
After exhaustive studies, it was decided that separate direct fired units with duct systems in each building would best meet all of the needs.

In each building an oil fired furnace with a bonnet capacity of 1 million Btu per hr and a bypass section with a blower were installed in the furnace room. The units were mounted horizontally. The furnace rooms are only 8 ft high.

The supply system of individual round galvanized iron ducts extends radially from each unit underground to each classroom. The ducts are placed approximately 2 in. below the surface of the floor slab. Thereby the slab is warmed as the air passes through the ducts to the supply diffusers which extend the full length of each classroom under the fenestration at the outside walls. A similar duct system in the all purpose room supplies warm air at the entire perimeter. The glass extends down to within 6 in. of the floor. The number of feeder ducts under the floor varies with the number of outside walls — one, two, or three — in each classroom. Concrete completely envelopes all underground ducts, with a vapor barrier placed beneath the concrete envelope.

Return air leaves the all purpose room through grilles in the step of the stage platform, runs in a concrete trench under the stage and is then picked up in two round ducts and carried back to the furnace blower. A riser tapped into the return air ducts extends vertically to a roof exhauster, so that a portion of the air leaving the all purpose room is discharged outdoors. Return air from each classroom is picked up in the base of a closet and returned in a radial system to the furnace blower. By arranging the classrooms with closets back to back, the return air ducts could be grouped in an economical manner which required only four radial ducts to handle all of the classrooms and lobby in each seven classroom cluster. The return air plenums are treated acoustically to prevent sound transmission between rooms.

Outdoor air taken in through a central duct from the roof of each building is mixed with return air, filtered, and circulated to all areas. During periods of unoccupancy at night time and weekends, the outdoor air intake closes, and all air is recirculated.



HOLDING DUCT IN PLACE when pouring concrete, wire supports occur at 4 ft intervals for ducts 16 in. or less in diameter and at 2 ft intervals for ducts 18 in. or more in diameter. Joints and other points were also wire supported as needed to insure rigid duct system during pouring. All concrete, insulation, and anchor work was done by the general contractor, who was responsible for maintaining ducts in place under the direction of the heating contractor

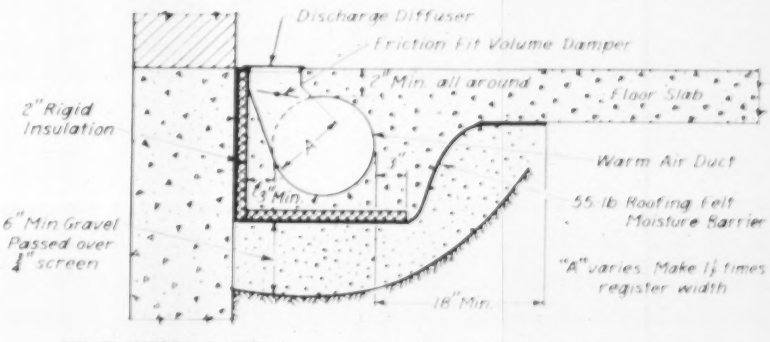
How System Is Controlled

Each classroom has individual temperature control accomplished as follows: Starting at the warm air bonnet an individual duct is run to each classroom. The furnace blower is removed from the furnace and a bypass plenum inserted between the blower and furnace. From the bypass plenum, an individual duct bypasses the furnace, and connects to the individual supply duct feeding each room at the warm air supply duct. Dampers actuated by a pneumatic control motor are positioned by the individual room thermostat to deliver air at a temperature which will satisfy the demand for heat. A constant supply of air is always delivered to each room during occupancy, but the temperature of the air is varied in accordance with room temperature demand. The constant air supply which consists of outdoor and recirculated air meets ventilation requirements.

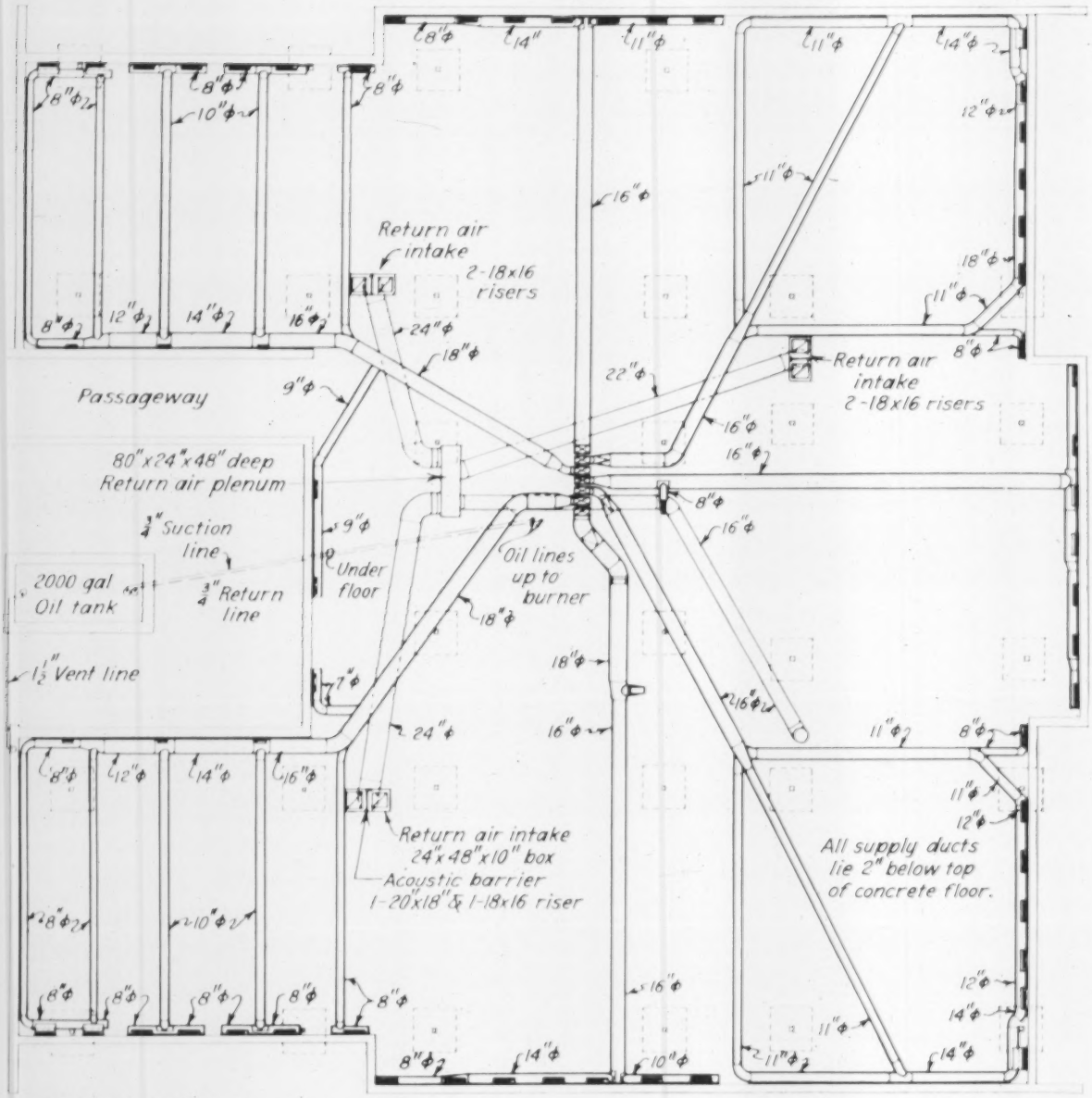
The exhaust from the classrooms is combined with wardrobe ventilation. In each classroom a wardrobe locker is on an inside wall, and backs up to the locker of the adjacent classroom. Air is drawn into the base of each wardrobe through slots, flows up through the locker, and is drawn through a grille into a plenum space above the locker. One 1000 cfm multivane blower in the plenum space draws air from a pair of wardrobes and is exhausted to the outdoors through a short discharge duct terminating in a louver in the outside wall.

Classroom cooling is accomplished by the use of outdoor air.

We designed a small flash steam boiler humidifier which is built into each furnace. The miniature steam boiler is a stainless steel tube, welded into the furnace, and extending into the fire box. Water fed into this tube is turned into steam immediately and



HEAT SUPPLY DUCT along outside wall has several diffuser outlets under fenestration which extends to within 6 in. of floor



BRANCH DUCTS take off the main supply and cross through some floors to diffusers at the opposite outside walls. Note that supply ducts cross over returns, which are in deeper trenches

is fed through a copper tube into the warm air bonnet, thus providing the needed humidification.

The heating and ventilating system cost $17,300, or about 9½ percent of the $182,000 total building cost. A system of this type requires closer coordination between the architect, engineer, and contractor than the usual heating system. The general contractor must make provisions for the heating system by providing trenches, concrete around the ducts and plenum spaces. During bidding, all subcontractors were assembled at a meeting, and the architects and engineers explained the system in detail so that no misunderstandings would arise during bidding or during construction. The complete integration of the heating system with the building, the grouping of rooms, plenums, and wardrobes, the central location of each furnace room, the absence of extensive trenches, and the small amount of corridor all contributed to the low mechanical costs. #

How to Maintain Fractional Horsepower Motors

THE PROBLEMS of maintenance on small motors—$\frac{3}{4}$ hp or less—are similar to those of large motors. However, there is a natural tendency to neglect maintenance on smaller motors.

Maintain to Prevent Breakdown

If preventive maintenance is neglected, breakdown maintenance become necessary. As a result, annual costs for motor repair and replacement may then even exceed costs of over-maintenance. Whether it is both economical and practical to repair small motors to the extent of rewinding them depends on what they are used for. Usually, however, it is better to replace defective motors with rebuilt or new motors than to repair them. Normally, a small motor with a burned-out winding is not worth repairing if the rotor spindle is bent or if the bearings are worn. It is often most economical to store defective and faulty motors and repair them at convenient shop time.

Good maintenance of small motors consists mainly of preventive maintenance on a fixed schedule according to operating conditions. Cleanliness and lubrication are the basic items to watch. Checks of terminal voltage and current should be made at least annually. A dirty motor will run, of course, but it will operate at higher than normal temperature, which tends to shorten the life of both insulation and bearings.

A card index maintenance file should be kept on each motor, or a log book showing the operating and maintenance history of each motor.

Why Do Small Motors Fail?

Poor bearing maintenance is a major cause of small motor failures. Dirt is the first enemy of bearings. Use only clean oils and greases, and clean applicators. Of course, where bearings are the prelubricated type do not lubricate. Lubricants should be suitable for the bearing loading and working temperatures. About once a year flush out bearing lubricant with a suitable solvent. If a motor has been idle for a period of time, change out the lubricant. Avoid overlubrication and too frequent greasing of ball or roller bearings. Too much lubrication with greases often leads to overheating of anti-friction bearings and eventual bearing failure. Silicone greases, used to advantage in lubrication of certain applications of ball bearings, should be considered for extremely high or low operating temperatures. Excessive oiling of sleeve bearings leads to slinging surplus oil on motor insulation which softens insulating varnishes. This leads to electrical shorts and other failures. Be familiar with the many ways to get lubricant to the bearing journal and adjust cleaning and lubrication schedules to each method. Before starting any motor, check to see that the rotor turns free, that no parts or tools are left in the motor, and that lubricants are actually getting to the bearings.

Check Other Common Defects

Split phase and similar type motors usually develop trouble with centrifugal starting switches. To isolate this kind of trouble when the motor fails to start alone, turn the rotor in the direction of normal rotation. If it starts and comes up to speed, the trouble is in the starting circuit. Check the operation of the starting switch and dress the switch contacts. Check the starting winding for open circuits. Also, check out all leads and connections. If a starting winding only is burned out, the running winding may not have to be replaced.

On capacitator motors, a two-position start-and-run switch is used. If there is excessive end-play in the switch, the movable contact of this switch may not make contact for the starting position. This is a common fault. If the motor fails to start, but runs when started by hand, then check for excessive end-play. This trouble can be usually corrected by adding washers to the end opposite to the switch, but do not eliminate all end-play.

With repulsion type motors, always check for high mica, good brush contact, and brush position. Most of the faults can be tracked to these three points. Trouble can also originate in the short-circuiter and brush-lifting device.

The reasons for failure of universal and d-c motors are similar to those for repulsion and commutator type motors. Excessive arcing at the brushes indicates either a dirty commutator or an off-neutral brush position.

Should Include Five Things

Your schedule for maintenance should include:

1) An operating record for each motor.

2) A systematic and scheduled program of inspection and routine maintenance. Keep the motors clean, dry, and lubricated.

3) A check for misapplication; see that the right motor is on the job. Do not use a large motor where a smaller one can do the job, and vice versa.

4) A repair program on the mass production basis, not on the custom-made principle. Work out a system of replacement and spare motors for each application.

5) Respect for the work little motors do for you.

Abstracted from the U.S. Navy's Bureau of Docks Technical Digest No. 55.

HPAC DATA SHEET

Here are common trouble symptoms of small motors. Also listed are possible causes, A, and their cures, B.

Symptoms You Can See

1) Excessive sparking or flashing at brushes. Blackened commutator.

A) *Rough commutator.*

B) Sand or turn down, depending on depth of surface roughness. Piece of sandpaper in a hollow wood block is a handy tool.

A) *Low bar on commutator.*

B) Grind or turn down balance of commutator.

A) *High mica.*

B) *Undercut.*

A) *Brushes too short.*

B) Replace — with next harder grade — if worn too soon . . . and not by rough commutator. (Sometimes under-loaded brushes wear abnormally fast.) Ordinarily, set should last for a minimum of 2500 hours.

A) *Insufficient tension.*

B) Adjust.

A) *Weak brush springs.*

B) Replace; then, check brush pressure to about 1½ pounds per square inch brush area.

A) *Brushes sticking in holders.*

B) Free them. Clean brushes and holders.

A) *Dirt or oil on commutator.*

B) Wipe off. Clean brushes if glazed, with sandpaper between brush and commutator.

A) *Water dripping on commutator.*

B) Plug source of drip — or rig up a protecting shield. Keep motor dry.

A) *Shorted armature winding.*

B) Test for short — after removing metallic contact between commutator bars. Repair armature.

2) Intermittent sparking at brushes.

A) *Open armature winding.*

B) Locate and replace bad coil — or repair defective joint.

3) Fine dust under coupling employing rubber buffers or pins.

A) *Misalignment.*

B) Realign.

4) Smoke, charred insulation or solder "whiskers" extending from armature.

A) *If evidence is of past overheating, check for loose soldered connections or overlubrication.*

B) The smoke is a warning signal that should not be ignored. Stop the motor. Check for defects. Correct the faults before re-starting motor.

5) Motor will not start.

A) *Usually fuse trouble single-phasing at starter.*

B) Correct. Check source of power supply. DON'T MERELY TRY TO MAKE IT GO — WHILE MOTOR SITS THERE AND "FRIES"!

A) *Load too heavy. Disconnect motor to see if it starts without load.*

B) Reduce load — or replace motor with unit of greater capacity.

Symptoms You Can Hear

6) Excessive hum.

A) *Uneven air gap. Measure with feelers.*

B) Replace bearings — before introduction of scraping noise indicates rotor is rubbing against stator.

A) *Unbalanced rotor. Check on parallel bars.*

B) Balance with solder on band — or weight attached by cap screw and lock washer.

7) Regular clicking.

A) *Foreign matter in air gap.*

B) Take out rotor; remove foreign matter.

8) Rapid knocking.

A) *Misalignment — probably causing shoulder of shaft to pound periodically against bearing end.*

B) Realign, set until knocking disappears.

9) Brush "chatter."

A) *Extreme motor vibration.*

B) See items 10 and 11, below.

Symptoms You Can Feel

10) Vibration.

A) *Misalignment.*

B) Realign set.

A) *Vibration in driven machine. Run motor disconnected from load for check.*

B) Eliminate source in machine, if possible. Or change to a flexible belt drive may be in order.

11) Vibration — following motor repair.

A) *Rotor out of balance, due to holes drilled or weights shifted . . . new rotor coil or coils.*

B) Balance rotor.

12) Motor overheating. (Check with thermometer — don't depend on hand).

A) *Overload. Measure load; compare with nameplate rating.*

B) Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with unit of greater capacity.

A) *Dirt in motor. Check flow of ventilating air.*

B) Blow out motor. Use solvent on wound section if necessary.

A) *Rotor rubbing on stator.*

B) Replace bearings.

A) *Shorted stator windings.*

B) Test with wattmeter and correct.

A) *Ground.*

B) Locate with test lamp or growler and repair.

13) Bearing over-heating.

A) *Misalignment.*

B) Realign set. In this — as in all cases of bearings over-heating — keep shaft turning until bearing is cooled . . . to prevent "freezing."

A) *Too much tension in chain or belt drive.*

B) Reduce tension to point of adequacy. Check alignment of pulleys.

A) *Excessive end thrust.*

B) Reduce thrust from drive or machine. (Shaft should be permitted reasonable "axial" float.) Or if motor is off level, shim-up lower end to take thrust off its bearing.

A) *Too much grease (ball or roller bearings).*

B) Relieve supply to quantity set by manufacturer.

A) *Sticking oil ring (Sleeve bearing).*

B) Clean, repair, or replace — as necessary.

A) *Insufficient lubricant.*

B) Add up to quantity set by manufacturer.

14) Commutator hot.

A) *Incorrect grade of brushes.*

B) Replace with proper grade — as specified by manufacturer, unless otherwise indicated.

A) *Excessive brush pressure.*

B) Decrease brush spring tension. ‡

HEATING, PIPING & AIR CONDITIONING
AMERICAN SOCIETY OF
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INTERMITTENT HEATING AND COOLING OF BUILDINGS

By P. L. Pfennigwerth* and Merl Baker**, Lexington, Ky.

SUMMARY: A discussion of the problems associated with the intermittent heating and cooling of buildings is presented together with an explanation of the method of finite differences as a suitable technique for analysis. Equations are developed for applying the method to intermittent heating and cooling problems. Certain assumptions are introduced in the development, and pilot experiments were conducted for validation. The principal contribution of this presentation is the establishment of certain boundary conditions which enables use of the method of finite differences to determine the load requirements of intermittently heated or cooled buildings.

AN IMPORTANT reduction in the cost of heating or cooling intermittently occupied buildings may be achieved by decreasing or terminating the conditioning plant during the unoccupied period. Heating or cooling must be resumed prior to occupancy in order that the temperature be restored to a comfortable level. The time required for preconditioning depends upon the thermal capacity of the building walls and furnishings, the temperature drift of the structure, outside air temperature and the plant capacity.

The plant must have sufficient capacity to meet the most severe load and this service requires that the plant rating be greater than that required for the steady state design load. The excess capacity depends on the time allowed for preconditioning and the thermal capacity of the building. Temperature drifts during inactive periods may be limited by a set back control, thereby alleviating the load during the preconditioning period.

The thermal storage of the outside walls in massive structures limits change of the temperature gradient near the weather side of the wall and it is practically unaltered during an inactive period of several hours. The temperature gradient at the inside wall surface, however, diminishes with time, and will possibly reverse in sign if a significant glass area exists. The decreased temperature gradient at the inside wall surface represents a reduction in heat exchange between the walls and room air during cooling periods. The room air receives heat from inside partition walls and furnishings and loses it through exposed glass, outside walls, and floors or ceilings.

To determine the temperature to which a structure will drift in a given time requires the application of transient heat flow analysis. Because of the complexity of heat transfer through the outside building walls, the application of theoretical equations is usually not feasible. The method of finite differences offers a practical and accurate means of solution. The heat transfer through glass and thin walls may be treated as steady state problems; the heat loss rate is proportional to the inside-outside temperature difference.

Boundary conditions are established enabling the application of this method to determine the building temperature drift during an in-

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For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR CONDITIONING ENGINEERS, Washington, D.C., June 1956.

active period, the time required for preconditioning, and the requisite plant capacity.

Solutions by Method of Finite Differences

The method of finite differences is well recognized as a means of analyzing complex transient heat flow problems. It is of academic interest only until it is supported by boundary conditions prescribed by the particular problem under consideration. It is therefore the objective of this presentation to establish inside surface boundary conditions permitting analysis of intermittent heating and cooling problems and to discuss pilot experiments conducted for validation.

Fig. 1 depicts the construction technique pertinent to determination of the temperature drop that occurs after termination of the heat supply to a heated building. During this cooling period, heat is liberated from the room air, partition walls and furnishings equaling that transmitted through the bounding surfaces—external walls, roof, floor, and glass. Building walls are usually massive and must be treated in accordance with the laws of transient heat flow while floors, ceilings and windows can usually be analyzed by steady state relationships. Partition walls may be sufficiently massive to necessitate the use of a transient analysis, however, for simplification the heat liberated by partition walls may be approximated as follows:

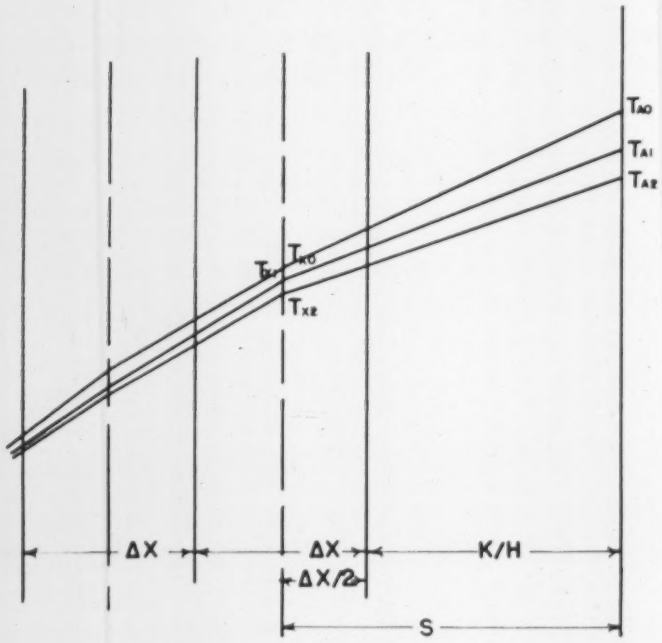


Fig. 1 — Line construction during the cooling period

$$Q_p = c_p m_p \Delta t n$$

where

- Q_p — heat liberated from partition walls in Δt hours.
- c_p — specific heat of partition walls.
- m_p — mass of partition walls.
- Δt — temperature change of room air in $\Delta \tau$ hours.

The temperature decrement, Δt, assumes that the wall temperature is uniform and follows that of the room air, a consideration which achieves expediency in application. The n term is introduced to compensate for the thermal lag of the partition wall and is defined as the ratio of the mean wall temperature decrement to the room air temperature decrement. This ratio may be approximated by calculation or experimental observation.

A mathematical expression relating the heat released from storage to that lost from the inside of the structure may be stated as follows:

$$0.24 m_a(\Delta t_a) + nc_p m_p(\Delta t_a) + c_f m_f(\Delta t_a) = \left\{ k_w A_w \left[\frac{\Delta t}{\Delta x} \right] + U_c A_c (t_a - t_c) + U_b A_b (t_a - t_b) + U_g A_g (t_a - t_g) \right\} \Delta \tau \quad (1)$$

where

- A — surface area, square feet.
- C — specific heat Btu per pound (Fahrenheit degree).
- k — thermal conductivity Btu per (hour) (foot) (Fahrenheit degree).
- m — mass of material.
- n — ratio of the mean change of the partition wall temperature to the air temperature change during $\Delta \tau$ hours.
- U — overall heat transfer coefficient Btu per (hour) (square foot) (Fahrenheit degree).
- Δt — change in temperature, Fahrenheit degrees in $\Delta \tau$ hours.

Subscripts a, b, f, g, o, p, r, and w refer to inside air, floor, furnishings, glass, outside air, partitions, roof or ceiling and outside walls respectively.

The method of finite differences is to be utilized in evaluating $\Delta t / \Delta x$. Fig. 1 depicts the temperature gradient at the surface of the inside wall and through the inside film. For the time interval $\Delta \tau$, the inside air temperature changes from $t_{a,0}$ to $t_{a,1}$ and the temperature within the wall at the center of the first Δx section changes from $t_{x,0}$ to $t_{x,1}$. Substituting for $\Delta t / \Delta x$ and considering the transmission loss to be dependent on the average air temperature over the time increment, $\Delta \tau$, equation 1 becomes

$$0.24 m_a (t_{a,0} - t_{a,1}) + nc_p m_p (t_{a,0} - t_{a,1}) + c_f m_f (t_{a,0} - t_{a,1}) = \left\{ k_w A_w \left[\frac{(t_{a,0} - t_{x,0}) + (t_{a,1} - t_{x,1})}{2S} \right] + U_c A_c \left[\frac{(t_{a,0} + t_{a,1})}{2} - t_c \right] + U_b A_b \left[\frac{(t_{a,0} + t_{a,1})}{2} - t_b \right] + U_g A_g \left[\frac{(t_{a,0} + t_{a,1})}{2} - t_g \right] \right\} \Delta \tau \quad (2)$$

where

s = distance between the equivalent inside film and center of first section, feet (see Fig. 1).

t_a, t_o, t_b, t_r, t_c = temperature of inside air, center of first wall section adjacent to inside air, outside air, beneath floor, and above the roof or ceiling, respectively, Fahrenheit.

Equation 2 is based on the average of the inside air temperature at the beginning and end of the time interval. Since the inside air temperature after a time lapse of $\Delta\tau$ hours is the object of calculation, it is expedient to approximate all transmission losses on the basis of t_a at the beginning of the interval. The value of $t_{a,1}$, end of interval, approximated on this basis may be employed to obtain an approximate mean for the interval, $(t_{a,o} + t_{a,1})/2$. The approximate mean temperature is used in a repeat calculation to determine $t_{a,1}$ more accurately. The successive approximations are continued until the desired degree of accuracy is achieved. For small time intervals, 2 approximations will usually suffice. By considering t_a the average inside air temperature over the time interval $\Delta\tau$, the statement of Equation 2 may be simplified.

$$\Delta t_a = \left[k_w A_w\left(\frac{\Delta t}{\Delta x}\right) + U_r A_r (t_a - t_r) + U_b A_b (t_a - t_b) + U_g A_g (t_a - t_o)\right]\Delta\tau \Big/ [0.24 m_a + n c_p m_p + c_f m_f] \quad \cdots\cdots (3)$$

For a particular study, constant factors may be combined and Equation 3 expressed.

$$\Delta t_a = \left\{\left[2SC_1\left(\frac{\Delta t}{\Delta x}\right) + 2C_2(t_a - t_r) + 2C_3(t_a - t_b) + 2C_4(t_a - t_o)\right]\Delta\tau\right\} \Big/ C_5 \quad \cdots\cdots (4)$$

where

$C_1 = k_w A_w/2S$; $C_2 = U_r A_r/2$;
$C_3 = U_b A_b/2$; $C_4 = U_g A_g/2$
$C_5 = 0.24 m_a + n c_p m_p + c_f m_f$

After $t_{a,1}$ is located in Fig. 1, this point is connected with $t_{r,1}$, completing the temperature distribution curve after a time lapse of $\Delta\tau$ hours. The temperature t_{x2} is located in the manner depicted by Fig. A-2, Appendix A, and $t_{a,2}$ is computed by Equations 3 or 4 by advancing by one the subscripts referring to the inside air.

A similar development is followed during the study of the preconditioning period of the cycle. During the preheat period the rate of heat supply exceeds the building losses, and the temperature of the structure rises. The following relationships are established in accordance with the notation of Fig. 2. The energy supplied, $R\Delta\tau$, is either transmitted through the boundaries of the structure or stored within the walls or internal masses: In equation form:

$$R\cdot\Delta\tau = (q_w + q_r + q_b + q_g)\Delta\tau + (0.24 m_a + n c_p m_p + c_f m_f)(t_{a,1} - t_{a,o}) \quad \cdots (5)$$

where

R = heat supply rate, Btu per hour.
q = rate of heat loss, Btu per hour, subscripts w, r, b, and g previously defined.

Basing all losses on the average of the inside air temperature at the beginning and end of the time period $\Delta\tau$, Equation 5 may be written

$$\left\{R - k_w A_w\left[\frac{(t_{a,o} - t_{x,o}) + (t_{a,1} - t_{x,1})}{2S}\right] - U_r A_r\left[\frac{(t_{a,o} + t_{a,1})}{2} - t_r\right] - U_b A_b\left[\frac{(t_{a,o} + t_{a,1})}{2} - t_b\right] - U_g A_g\left[\frac{(t_{a,o} + t_{a,1})}{2} - t_o\right]\right\}\Delta\tau = (0.24 m_a + n c_p m_p + c_f m_f)(t_{a,1} - t_{a,o}) \quad (6)$$

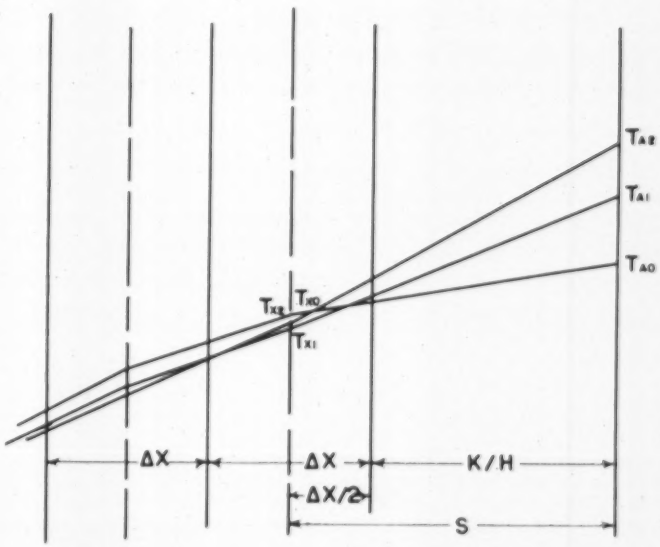


Fig. 2 — Line construction during the heating period

Solving for $t_{a,1}$ gives

$$t_{a,1} = \{R\Delta\tau + [C_1(t_{x,o} + t_{x,1} - t_{a,o}) - C_2(t_{a,o} - 2t_r) - C_3(t_{a,o} - 2t_b) - C_4(t_{a,o} - 2t_o)]\Delta\tau + C_5 t_{a,o}\} \Big/ \{C_5 + [C_1 + C_2 + C_3 + C_4]\Delta\tau\} \quad (7)$$

Also by analogy with the formulation of Equation 1

$$\Delta t_a = \left\{R\Delta\tau - \left[2SC_1\left(\frac{\Delta t}{\Delta x}\right) - 2C_2(t_a - t_r) - 2C_3(t_a - t_b) - 2C_4(t_a - t_o)\right]\Delta\tau\right\} \Big/ C_5 \quad \cdots\cdots (8)$$

The constants are the same as defined in conjunction with Equation 1. The time required for preheating is determined by the successive application of Equations 7 or 8 until the

inside air temperature reaches the normal level.

Description of Experimental Apparatus

To verify the proposed equations, a test box was built to maintain controlled conditions. This box representing a building space or a room was constructed of 1 5/8 in. dry fir wood planks. The shape was approximately cubical and the inside surface area and inside volume were 35.94 sq ft and 17.53 cu ft respectively.

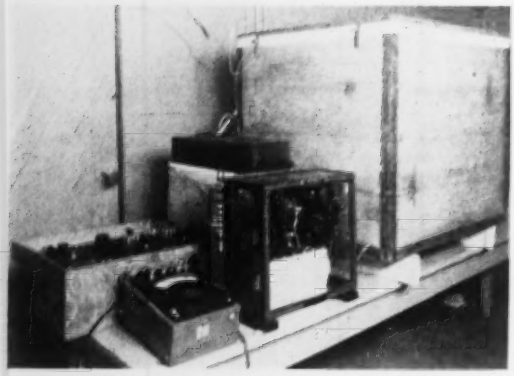


Fig. 3 — Experimental apparatus

In order to approach the ideal case of unidirectional heat flow through the walls, the inside edges were aligned and the edge space was filled with granulated cork board insulation. The plank joints were butt glued to minimize discontinuities. Metal fasteners were used to assemble the 6 wall sections, but were placed at the edges only and morticed into the cork board.

The room furnishings were simulated by 2 beds of steel lathe turnings. One basket containing 25 lb of chips was supported on runners about 1 in. from the floor, and the second containing 35 lb of chips was supported at the approximate midplane of the box. Lathe turnings were used because of their large surface-to-mass ratio which would minimize temperature lag and thus closely assume temperature equality between the chip mass and air.

Heat was supplied by an electrical resistance heater having 10 helical nichrome coils extending the width of the box, and spaced uniformly over the length. The heater and frame contributed about 2 lb to the mass of the furnishings, and was suspended in a horizontal plane, midway between the 2 chip beds. By virtue of this arrangement the radiation component of the heater was intercepted by the chip beds and heat transfer to the walls of the box was essentially by convection. The heater was designed for a surface temperature of about 600 F at an output of 770 watts in free air.

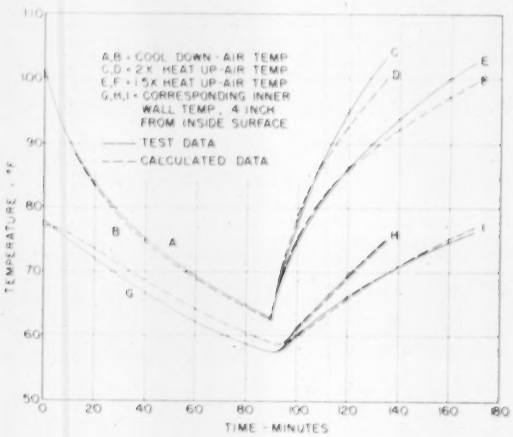


Fig. 4 — Comparison of calculated and experimental structure temperature

The outside environment of the box was maintained by placing it within a constant temperature cold room. The air in the room housing the box was recirculated through the evaporator coil by forced convection which insured thorough mixing of the environment air.

Instrumentation

All temperatures were measured with thermocouples in conjunction with both a precision type and a recording potentiometer. In order to measure the representative space temperatures, 9 thermocouples were distributed throughout the air volume and chip beds and could be read either singly or in parallel. The inside and outside surface temperatures were determined by 12 thermocouples held in the plane of the surface by strips of cellulose tape. To enable an additional check on calculated results, thermocouples were also embedded within the walls at intervals between the inside and outside faces. One set was placed at the geometric center of each of the 6 faces and at a plane 0.4 in. within the wall measured from the inside surface. These 6 thermocouples could be read either singly or in parallel. In addition, one wall contained additional thermocouples at the center plane and at a section 0.4 in. within the wall measured from the outside surface. In order to minimize disturbance to the temperature pattern within the walls, number 30-gage thermocouple wire was used, and the leads were pressed in butt joint parallel to the plane of the wall surface for several inches from the junction point. The heater capacity was measured by a precision wattmeter and regulated by a variable output transformer. A photograph of the test box is shown in Fig. 3.

Determination of Physical Properties

Auxiliary tests were conducted to determine as accurately as possible

the density and specific heat of the wood. By weighing a given volume the density was found to be 27.8 lb per cu ft. The specific heat was determined as 0.37 Btu per (lb) (F deg) by the method of mixtures. The thermal conductivity was calculated using measured values of energy input to the test box at steady state conditions, wood thickness, and surface temperature differences. The average value was determined to be 0.712 Btu per (hr) (sq ft) (F deg).

Discussion of Experimentation

Calculated and experimental results for the test box are compared by the curves of Fig. 4. Curve A represents the average of 2 nearly identical cool-down tests conducted on different days, but under the same conditions. Curve B was obtained by application of Equation 1 which for all practical purposes is coincident with Curve A. Experimental values for the physical properties together with film coefficients of 1.49 inside and 2.52 outside, measured at the initial time, were employed in the determination of Curve B. Sample calculations are presented in Appendix B.

Curve C depicts test results for the preheat portion of the cycle during which the temperature was restored to the initial value. This occurred in 11 min, with the heat input being twice that required to maintain the desired inside temperature under steady state conditions.

Equation 5 was employed to locate points of Curve D. The ascending warm air currents over the central area of the box in conjunction with the descending currents near the cold wall apparently produced an important increase in the inside film coefficient over the value determined for steady state.

A mean value for these film coefficients during preheat was calculated based upon the rate of energy supplied to the box less the quantity stored in the chip bed and air mass during the same period. Using the mean measured temperature difference across the inside film during this period, the representative film coefficient was then calculated. As revealed by a comparison between Curves C and D the calculated temperatures are higher than corresponding test values during the early part of the period, but undergo a reversal, with the calculated temperature falling approximately 3 F deg below the experimental value at the final time. Although other factors may be pertinent, the deviation is believed to be caused by an actual film coefficient higher than the mean which was used for calculation, during the first part of the cycle and lower during the latter part. A similar comparison is observed between Curves E and F in which case the rate of preheating is 1.5 times the steady state value.

The temperature lag within the wall is evident from a study of Curves G, H, and I which represent values at 0.4 in. within the wall measured from the inside surface. The deviation between the calculated and experimental curves is believed to be insignificant.

Application

Calculations for an actual structure may be made in exactly the same manner as discussed in this article for the experimental box. It will be necessary to ascertain the thermal properties of the building material and make certain simplifying assumptions such as the relative temperature change of the furniture compared to the room air. If the furniture is well distributed and not massive, it may be assumed to approximate the room air temperature at all times.

Conclusions

The method of finite differences may satisfactorily be employed to predict the rate of temperature change and time required for preconditioning the intermittent heating or cooling of buildings. Previous reports have dealt with this application; however, the contribution of the present analysis is believed to be unique in the treatment of the boundary conditions.

Journal Section

The resulting equations are confirmed within experimental error by laboratory studies. The aberrations between calculated and observed results are believed to be primarily caused by the varying inside film coefficient during the experimental studies. An unstable and higher coefficient than that existing during steady state conditions is anticipated during the preheat portion of the cycle for the prototype structure.

Based on the boundary technique presented, the method of finite differences may be applied to any structure to evaluate any of the following: (*a*) Temperature drift during inactivity of the heating or cooling plant; (*b*) Time required for preconditioning; (*c*) Economy of intermittent operation; (*d*) Heat gain at the inside surface during isothermal cooling operations due to fluctuation of outside wall surface temperatures.

The following recommendations are believed to be important in achieving a more complete understanding of intermittent heating and cooling of buildings:

1. Investigation of the inside film coefficient during the preconditioning period of a full-scale structure.
2. Evaluation of the rate of heat exchange between inside partitions and the surrounding air.
3. Analysis of possible heat savings from intermittent heating and cooling by application of the proposed equations to structures of various constructions and subject to various environments.
4. Analysis by the proposed boundary technique of the heat gain during summer cooling to a structure resulting from the intermittent heating and cooling at the weather side of walls.

APPENDIX A

Binder-Schmidt Method

The Binder-Schmidt method represents a solution of the basic heat flow equations based upon consideration of small finite differences. The result is an approximate rather than exact solution. The approximate analysis, however, is so versatile as to be applicable to numerous engineering problems which are not solved feasibly by exact methods.

The principle of the Binder-Schmidt method is presented according to the

analysis given by Raber and Hutchinson[1]. Consider the element of wall, Δx, Fig. A-1. Construction lines are located a distance $p = K\Delta x$ on either side of the center line of the section. Also consider that the temperature distribution through the section at some particular time is given by lines gb, bf.

The rate of heat flow into the element from the left is

$$q_i = -kA(\Delta t/\Delta x) = -kA(\text{slope } ab) + kAb'c/p$$

Heat leaves the section toward the right and is given by

$$-kA(\text{slope } bf) = -kAb'c/p$$

and that *entering* from the right is

$$q_o = kA(\text{slope } bf) = kAb'c/p$$

The total heat entering the section, $\Delta\tau$, is

$$(q_i + q_o)\Delta\tau = kA\Delta\tau(b'c + b'c/p)$$

and effects a mean temperature rise of

$$A\rho c(\Delta t)(\Delta x)$$

where

A = surface area normal to direction of heat flow, square feet.

c = specific heat of the wall material, Btu per (pound) (Fahrenheit degree).

k = thermal conductivity of the wall material, Btu per (foot) (hour) (Fahrenheit degree).

K = a factor defined by the equation $p = K\Delta x$.

p = distance of the 2 construction lines on either side of the section center line, feet.

Δx = the thickness of the section, feet.

$\Delta\tau$ = a time interval, hour.

Δt = a temperature difference, F.

ρ = density of the wall material, pounds per cubic foot.

Rearranging the terms of the previous equation and employing geometrical identities obtained from Fig. A-1.

$$(b'c + b'c)/p = [\rho c(\Delta t)/(\Delta x)]/k(\Delta\tau) = cc/p.$$

By similar triangles, $bd = \frac{1}{2}cc$, or $cc/p = 2(bd)/p$.

Substituting, then

$$[\rho c(\Delta t)(\Delta x)]/k(\Delta\tau) = 2(bd)/K(\Delta x)$$

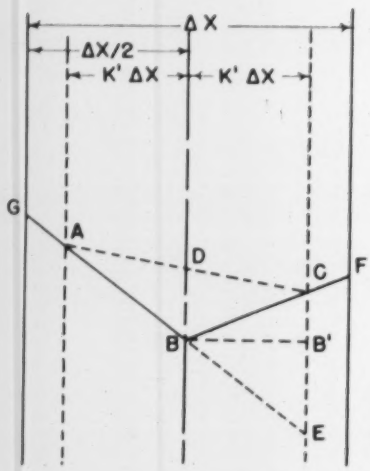
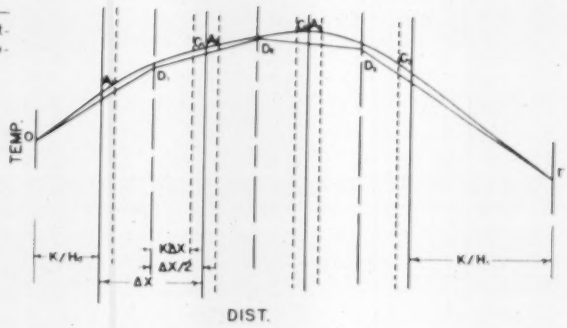


Fig. A-1 (left) — Line construction for the method of finite differences

Fig. A-2 (right) — Technique for treating surface film coefficients



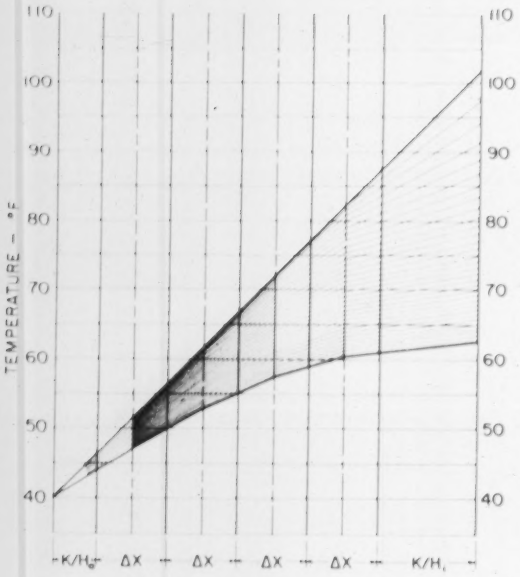


Fig. A-3 — Temperature distribution through structure wall during cooling

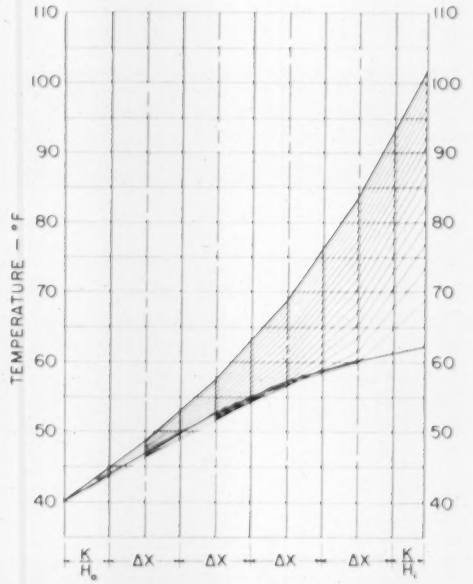


Fig. A-4 — Temperature distribution through structure wall during preheating

[1]Refrigeration and Air Conditioning, by R. F. Raber and F. W. Hutchinson (John Wiley & Sons, Inc., New York, N.Y.)

By definition the thermal diffusivity, a, is equal to $k/\rho c$.

Solving for the distance bd, it follows:

$$b\,d = \Delta\tau\,\{[K/2\,a]\,[(\Delta x)^2/(\Delta\tau)]\}$$

If,

$$(K/2\,a)\,[(\Delta x)^2/(\Delta\tau)] = 1 \quad \ldots(A\text{-}1)$$

then, the distance bd represents the mean change in temperature of section Δx occurring during a time interval of $\Delta\tau$ hours.

This is significant because point d is located by the intersection of the section center line with a straight line connecting points a and c. Furthermore, Equation A-1 can always be made valid since Δx, $\Delta\tau$, and K may have arbitrary values for any particular wall. The section width must be taken such that an integral number of sections exists for the wall under consideration. The smaller the value of Δx, the greater is the accuracy of the solution. The recommended value of K ranges between $^1/_4$ and 1. By choosing both Δx and K, $\Delta\tau$ is established by Equation A-1.

Application of the Binder-Schmidt method requires that the initial temperature distribution through the wall be known. In most engineering problems, the temperature of the fluids adjacent to the wall surface is known rather than the temperature of the surface. When such boundary conditions are known, a hypothetical thickness of the wall material is considered to replace the fluid film so that the thermal resistances are equivalent. The equivalent thickness of the film is k/h. Because of the negligible mass of material, thermal lag within the film is considered zero; and the slope of the temperature distribution line passing through the hypothetical film thickness and the adjacent solid wall surface must be identical.

The technique of applying the Binder-Schmidt method is illustrated in Fig. A-2. Curve O, a, c, a_2, c_2, a_3, c_3, i represents the initial temperature distribution through the material. According to the previous discussion, point d_1 is located by the intersection of a straight line connecting points a_1 and c_1 with the center line of the section. Points d_2 and d_3 are located similarly. The curve connecting points O, d_1, d_2, d_3, i represents the temperature distribution through the wall after a time lapse of $\Delta\tau$ hours.

Particular Application: Analysis of an intermittent heating problem requires consideration of the cooling period in addition to the preheating portion of the cycle. Fig. A-3 illustrates the application of the Binder-Schmidt method to the cooling of a space after cessation of heat supply. The top curve represents the initial temperature distribution. For design purposes it is assumed that this represents a steady-state condition, and therefore, the gradient is linear. Subsequent lines represent successive temperature distributions after intervals of $\Delta\tau$ hours, as determined from Equation A-1. The corresponding air temperatures after each time interval are calculated from Equations 3 or 4. This process is continued until the desired degree of cooling has been achieved.

The gradient existing at the end of this cooling period is then taken as the initial condition for the construction shown in Fig. A-4 which is the preheat period. Construction is continued, and air temperatures are calculated using Equations 7 or 8. This procedure is continued for an assumed heat supply rate, R, until the normal air temperature is achieved, and the preheat time is thus determined.

The particular constructions presented here pertain to the experimental test box. The preheat curve is for a heat supply rate 2.0 times the steady-state heat loss. The construction for a heat supply rate of 1.5 is identical except that because of the slower rate of heat up, construction lines are more closely spaced, and more time intervals are required to achieve the same normal air temperature.

APPENDIX B

Sample Calculations

Calculation of time interval: This is as follows.

ρ	27.8 lb per cu ft.	
k	0.712 Btu-inch per (sq ft) (hr) (°F deg).	
c	0.37 B per (lb) (°F deg).	
Δx	$^1/_4'' \times 1\ ^3/_8$ in. = 0.0331 ft (four wall sections).	
a	$k/\rho c$ = 0.00677 sq ft per (hr).	

From Equation A-1

$$\Delta\tau = k\,(\Delta x)^2/2\,a$$
$$= 0.02475 \text{ hr}$$
$$= 2.85 \text{ min}$$

Cooling heat balance equation: Certain terms of Equations 3 and 4 are not pertinent to this application. Thus C_w, C_b, C_s = 0 and also m_s = 0. The remaining terms are

k_w	= 0.712 Btu-in. per (sq ft) (hr) (°F deg)
A_w	= 45.94 sq ft
$\Delta\tau$	= 0.0475 hr
m_a	= 1.25 lb
c_a	= 0.1062 Btu per (lb) (°F deg)
m_f	= 57 lb

Substituting these values into Equation 6

$$\Delta t_a = 0.0155\,(\Delta t/\Delta\tau) \quad \ldots(B\text{-}1)$$

Sample calculation for Δt_a after time interval No. 1: From Fig. A-3

$$(\Delta t/\Delta\tau)_1 = 170 \text{ F per ft}$$

Applying Equation B-1

$$\Delta t_a = 2.63 \text{ F}$$
$$t_a = 91.28 + 2.63 = 93.65 \text{ F}$$

The construction of Fig. A-3 is then completed using this tentative value. Then

$$(\Delta t/\Delta\tau)_1 = 141; \text{ and } (\Delta t/\Delta\tau)_{1\text{-}2} = 155 \text{ F per ft}$$

Using this mean value in Equation B-1

$$\Delta t_a = 2.40 \text{ F}$$
$$t_a = 93.85 \text{ F}$$

The final construction is then made using this value. This method of approximation is only necessary during the initial periods when the rate of temperature change is high. In this instance, the 2 approximations differed by less than 0.1 deg after the eighth time interval, and only one calculation was therefore made for each of the remaining ones.

Preheat heat balance equation

R	404 watts
	1380 Btu per hr

From Equation 8

$$\Delta t_a = 1000 - 0.0155\,(\Delta t/\Delta\tau)_{1\text{-}2} \quad \ldots(B\text{-}2)$$

The method of application follows that for the cooling period.

F. PAUL ANDERSON AWARD

The Committee of Award for the F. Paul Anderson Medal announces that nominations for the F. Paul Anderson Medal for 1956 are invited. Any member of the Society is eligible for nomination. The award is made in recognition of work done or service performed in the field of heating, ventilating or air conditioning.

Nominations, together with a full statement of the candidates' qualifications and achievements, should be sent to the Committee at ASHAE Headquarters, 62 Worth St., New York 13, N.Y., prior to August 1, 1956.

F. PAUL ANDERSON COMMITTEE
P. B. GORDON, *Chairman*
ALBERT BUESCHER — L. N. HUNTER
W. L. FLEISHER — A. J. NESBITT

Society Research Can Ease the Engineer Shortage

By E. R. Kaiser, Cleveland, Ohio

Most professional groups know of the current engineer shortage. Probably few realize how helpful the Society Research Program can be in solving this problem.

This engineer shortage is felt generally, and air-conditioning consulting firms, contractors and manufacturers are no exception. Lack of engineers *could* slow down the boom in air conditioning. The current rate of shortage for the whole country is estimated at between 10,000 and 17,000 annually, representing the spread between the supply of 22,000 engineering graduates in 1954 and the estimated annual need for 33 to 39 thousand.

With the present shortage many questions arise, among them being:

1. Will the heating, ventilating and air-conditioning profession and industry get their share of the limited engineering talent?

2. How can present engineering personnel be best used?

3. How can the productivity of present staffs be increased?

This is where the research plan of the American Society of Heating and Air-Conditioning Engineers provides at least a partial and helpful answer, one which is already in effect.

At an increasing rate, design data for product design and application are being provided by the Society's Research Program through projects at the Laboratory in Cleveland, and at nine cooperating institutions. Each engineer on a project is, in effect, working for 10,000 member engineers and hundreds of companies who help sponsor his work. Each sponsor receives the finished report automatically and can conserve his own time and staff for application of the findings. The cost to each sponsor is minor to inconsequential in proportion to the total cost of the projects, but in the aggregate makes possible major progress and benefits.

For example, the ASHAE project to develop the much-needed method for measuring and rating the noise emission of fans and other air-conditioning equipment, is a case in point. A single engineer is conducting the program. Guidance is provided by experts from industry who serve on the Technical Advisory Committee on Sound and Vibration Control. These men helped organize the program and meet two or three times a year to review the findings. Financial support is provided in this case by earmarked contributions from 43 companies and by the Society membership. When the results are complete, they will be published and made widely available.

Although the entire program may cost $40,000, the cost to no company will exceed $1500. Were a company to attempt the work, the cost of instrumentation alone would be $4000. Few companies could afford the expense of undertaking the task alone; none would have available to it the expert guidance of the TAC. The fact that the results would be available to all, increases, rather than decreases, the value of this research.

There are 21 other projects now under way in the ASHAE $240,000 Research Program. Except for the extremely valuable but occasional committee work by 275 engineers on the Technical Advisory Committees and Committee on Research, the engineers in the industry and profession are free to utilize, rather than to develop, the same know-how on the subjects under investigation.

The research should now be increased to accelerate progress. The Long-Range Research Planning Committee has listed 143 subjects of *immediate importance*. Delays in obtaining the findings may become more costly than the cost of the research itself. The answers must be obtained by research eventually. By re-investing in research through the Society by voluntary contributions of $100 per $1,000,000 of sales and services (0.01%), engineering manpower can be utilized more effectively and thus ease the shortage. Looking forward to technical problems that will be faced in the years ahead, this research should be started NOW.

Environmental Physiology

By R. W. Keeton*, M.D., Chicago, Ill.

SUMMARY — Review of the Society researches on the effects of air environment on the feeling of comfort of people, and an outline of certain problems already studied and of others projected.

A problem already investigated is the one of entering and leaving shock, shown to be of but slight concern in spite of early fears that it might endanger health.

An unsolved projected problem is that of the effect of comfortable environment on industrial productivity. Its study requires a knowledge, now relatively complete, of the physiology of muscular activity. An outline is given showing how this problem can be approached.

It is with great humility that I accept the F. Paul Anderson Medal. In so doing, I wish to emphasize the large contributions of my associates in the Departments of Medicine and Mechanical Engineering of the University of Illinois to the formulation and completion of our studies. The award emphasizes the importance which the Society has come to attach to *Environmental Physiology* as a field for investigation, the results of which are of great value to the general public.

F. Paul Anderson was an educator at heart, a faculty early recognized in his career by his appointment to the deanship of the School of Mechanical Engineering of the University of Kentucky, one year after he joined the engineering faculty. Later he became dean of the College of Engineering. His vision that engineering schools should teach fundamentals, combined with his great personal drive in support of his convictions secured recognition for Kentucky's College of Engineering. Thirty years after joining the staff of the University of Kentucky he became the first director of the Research Laboratory of the ASHVE. Under his directorship the experiments in the field of *Environmental Physiology* established the comfort chart and effective temperature. The practical importance of these studies was at once widely recognized. In 1927 Bazett[1] summarized critically the studies on Physiological Responses to Heat. He reproduced the charts showing the effective temperature scale for human subjects fully clothed and stripped to the waist, and indicated that this was another important approach to the measurement of the cooling power of the atmosphere. From the Society's point of view these studies represented a turning point in its research interests. The Society now recognized that in addition to physical problems involving equipment and process air conditioning that they were also confronted with the physiologic problems of comfort air conditioning involving effects of machine-made atmospheric environments on people.

We may now briefly turn to some of the problems in *Environmental Physiology* which have been studied and to others projected.

Entering and Leaving Shock

The distressing sensations produced in individuals entering from the hot humid street a space conditioned for comfort, or leaving the comfortable environment and returning to the hot humid street, have been designated as *entering and leaving shock*. Because these sensations were so distressing laymen and many physicians were convinced that such exposures were dangerous to health. Since 1950 there has been an increasing tendency in designing air-conditioned spaces to abandon the differentials previously proposed for outside and inside air in summer and winter. Our studies at the University of Illinois[2] have shown that these transitions from widely different environments are made with physiological ease and without danger even to individuals with compensated heart disease. For well people there is no need for being concerned about indoor-outdoor temperature differentials either summer or winter. W. M. Vidulich, ASHAE Public Relations Director, has aptly summarized the studies by the caption, *Keeping Cool Won't Harm You.*

Effect of Comfortable Environment on Industrial Productivity

It would seem that a comfortable worker should be more productive than an uncomfortable one. Discomfort introduces certain distracting psychological factors which are in abeyance in comfortable conditions.

There is a growing feeling in industry that, when large groups of workers are observed over long periods of time, their unit production is higher under comfortable than under uncontrolled environmental conditions. This impression is reflected in the striking increase in installations of air conditioning in office buildings. However, it is difficult to secure objective evidence to support the validity of this impression or to clarify the mechanism responsible for the improvement. The study of the effect of the environment on production requires a knowledge of the physiology of muscular activity and especially the mechanism of muscular contraction. Once this is understood, the effects of loads imposed by the atmospheric environments on muscular activity can be measured.

The origin of the energy for muscular contraction, its transfer, and its restoration, had been studied intensively from 1920 to 1930. An agreement on the present concept of the physico-chemical changes involved was summarized by A. V. Hill[3] in 1932. The energy for the contraction of muscle is derived primarily from the dissociation of phosphocreatine (phosphagen). In the presence of oxygen resynthesis of phosphagen occurs readily. Normally a deficit of oxygen rapidly develops in the contracting muscle. The energy for the resynthesis of phosphagen must be obtained from a reaction which can proceed under anaerobic conditions. This is found in the formation of lactic acid from the muscle glycogen. The extent of the oxygen debt is indicated by the quantity of lactic acid present. With these chains of reaction occurring within the oxygen deficient muscle cell the H and OH ions may become unbalanced with an accumulation of

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[Exponent numerals refer to References.
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lactic and other acids to the point at which both the chemical reactions and the muscle contractions are slowed. The process by which the composition of the fluids within the muscles and the lymph are maintained so that such reactions as previously described can proceed smoothly, is defined as homeostasis. Once homeostasis becomes unbalanced it may be restored by slowing the pace of the work until more oxygen becomes available, by diffusion of the unbalanced ions into the blood stream and by their excretion through the kidneys and lungs.

Fatigue is a term applied to a state resulting from work. Up to the present there has been no entirely satisfactory definition formulated. It has been divided into mental and physical fatigue. The symptoms arising from mental exertion are relegated to the psychologist[1] and those from physical exertion are allotted to the physiologist. Since fatigue is considered an important limiting factor of work one is forced to accept some definition of it if he plans to investigate the factors governing production. Dill has a most stimulating approach to a classification of the types of fatigue. He has pointed out that moderate work which requires an energy expenditure of three times the basal metabolic rate does not induce exhaustive changes in the muscle. The seat of fatigue due to work of this magnitude must be found elsewhere than in the muscle. He classified these symptoms under the term of *boredom*. Perhaps we might place in this class also *loss of motivation*. The amount of muscular energy transformed is small. The effects of the physical environment on changes in the muscle is almost negligible. The seat of such symptoms should be found in the cerebrum, in the synaps of the nervous pathways leading to the muscle, or in purely psychological attitudes. When hard work is performed, which requires an expenditure of energy eight times the basal metabolism, then fatigue changes occur within the muscle. With further expenditure of energy (maximal work) the continuation of work becomes intolerable.

Environmental conditions now become most important. A significant increase in the heat load, or a change in the conditions which make heat elimination more difficult may cause a complete stoppage of work. Under these conditions the circulation is unable to deliver sufficient blood and oxygen to maintain the normal physicochemical reactions necessary for muscular contraction. The seat of this fatigue is to be attributed to the failure of the general service functions of the body, circulation, urinary secretion, and respiration.

This is a most helpful outline to follow if one attempts to compare performance of groups of workers under experimental conditions. Even if one is unable to secure quantitative measurements of the fatigue in these various fields, it is most important to locate the field in which performance lags.

We may now return to the original question which provoked this discussion. If one is to compare the effects on production of a comfortable with an uncomfortable environment, he can select the field in which he wishes to develop fatigue symptoms by the severity of the assigned work. It will be necessary next to develop a quantitative factor for the physiologic stress that each environment imposes. This question will doubtless have to be solved by obtaining some integrated factor for the additions and subtractions of heat by a given non-uniform environment to and from a human subject.

Dr. Belding and Professor Hatch[6] presented before the Society an index for evaluating heat stress developed in certain industrial situations where the stress is of sufficient magnitude to cause physiologic strains. If this or some modification of it could be developed for varying conditions where the stress is less severe, then it should be possible to measure the effect on production of any selected environmental condition.

I should like to close by pointing out that productive and successful laboratory investigations in the fields, which I have discussed, require research teams composed of men trained and experienced in both the physical and biological sciences, and elaborate physical facilities for controlling and evaluating the environments and for measuring the responses of human beings to the different environments. Emphasis should be placed on fundamental studies which are time consuming. Laboratory studies should be supplemented with controlled field investigation.

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EFFECT OF UNBALANCED AIR PRESSURE ON PERMEANCE

By F. A. Joy* and D. R. Fairbanks**, University Park, Pa.

SUMMARY.—The performance of vapor barriers in service may be different from the results obtained in simple dry-cup tests. In this paper—the first of 3 on the variation of permeance under a wide range of service conditions—the effect of air pressure is shown to be large for porous materials. The possible use of air pressure as a vapor block is suggested.

MOISTURE is vital to all life, but its behavior is both blessing and bane in modern living. The blessings we accept. Until recent years the damages of moisture were also accepted with only a mild protest. Increasingly, however, attention is directed to the prevention of these damages — the corrosion of metals, the rotting of wood, the blistering of paint on houses — to cite only a few. Today a huge industry provides packages that retain moisture in lettuce or exclude it from crackers. Buildings also are packages.

A vapor barrier is required in most buildings and its effectiveness in reducing exterior paint damage and moulding within frame structures has been demonstrated. This damage is a winter phenomenon that has developed, not because paint is poorer or wood is different from what it was in grandfather's day, but rather because housing standards and habits have changed. Houses are built smaller and tighter. More water is used for bathing and for automatic kitchen and laundry devices that frequently discharge steam into the house. With no fireplace to draw this water vapor up the chimney, it condenses on the windows and in hidden places within the structure unless a vapor barrier prevents its entrance thereto. Without such moisture control, the house walls and roof may become wet in winter. This moisture migration is outward.

When air conditioning is used, moisture tends to move into the building in summer. This movement rarely damages the building but it adds to the cooling cost and may even overload the cooling equipment and render it ineffective.

Residential or commercial buildings cooled only for comfort furnish no major difficulty in moisture control. Much more difficult are the problems in the construction of cold rooms, refrigerated vessels and pipe lines. In these cases, moisture enters from the exterior and accumulates in the insulation increasing its heat transmission and sometimes seriously damaging its structure. As the cold space may never be warm, there is no season for drying out the insulation, and the moisture accumulation mounts from year to year. It is evident that a vapor barrier for such applications should be highly efficient. A considerable cost can be justified.

Mechanisms of Moisture Movement

The causes of moisture migration have been discussed by many authorities [1,2,3] and the following mechanisms have been recognized:

1. Molecular diffusion through air in a porous body.
2. Molecular diffusion through a nonporous solid.
3. Film spreading (adsorption and absorption) within a porous body.
4. Transport in a mass movement of air.
5. Capillarity.
6. Osmosis.
7. Gravity.

Many observers have placed emphasis on the first mechanism and undoubtedly it is the most important in many situations. For this case, Fick's Law for vapor diffusion applies. For a porous sheet material, the relation is:

$$\mathit{II} = M a t \Delta p \qquad (1)$$

where

II = Weight of the vapor transmitted through area a in time t when the vapor pressure difference across the sheet is Δp.

M = permeance of the sheet as it is made and used.

This factor has often been called its *permeability*, but such usage is improper since *permeability* is a property of the substance, numerically equal to the permeance of a unit thickness. Fortunately, these terms are now being used correctly. They have been standardized by the *ASTM* and there is much less confusion. The unit of permeance used in the building industry is a *perm*, defined by *ASTM* as one grain per (sq ft) (hr) (in. Hg vapor pressure difference).

But Fick's Law does not apply to any of the other 6 mechanisms and 1 or several of these may be operating at the same time as vapor diffusion through pores. Most complicating is the fact that when 2 mechanisms are operative they are not independent of each other. A relation that defines the combined result of all mechanisms would be complicated and it has not been formulated. Instead, Equation 1 is customarily used. This is generally adequate for engineering work when it is recognized that the coefficient M in the equation is not a constant for all conditions. The value of M (or permeance) for a given sheet must be selected to fit the exposure conditions. With complete information about its value under all conditions, the choice is properly made and the computation is correct in spite of the complicated behavior within the sheet that is not fully understood. Unfortunately, however, there is not complete informa-

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[1] Figured numerals refer to References.

tion of this kind for many materials that are, or may be, important for engineering use. Indeed, the information is so scanty that only the basic concepts of water vapor transfer are readily available.

Factors Affecting Permeance

In response to this need, an investigation was undertaken in 1952 in 3 areas as follows:

1. Effect of unequal total pressures on water vapor permeance.
2. Effect of low temperature on water vapor permeance.
3. Effect of relative humidity on water vapor permeance.

This paper confines itself to the first of these 3 areas.

Unbalanced pressure on a vapor-resisting sheet or structure is not an unusual condition in practice. The pressure of wind on a house is likely to be felt by the vapor barrier installed in its walls. In cold-room construction, the greater density of air within the room produces an unbalance outward near the floor; inward near the ceiling (modified if there are vents). In the walls, a potential unbalance exists since the air therein has a different density from the air on either side. These facts raise a question whether the standard cup tests are adequate to determine the performance of vapor barriers and other members in such service.

The work here reported was done on a limited number of sheet materials, chosen primarily for their diverse characters rather than for their importance as vapor control membranes in buildings. This diversity provides a broad view of the effect of total pressure, leading to generalized conclusions.

Apparatus and Methods

The test cell, sometimes called the *Banjo Cell* was the basic apparatus. This has been described in an earlier paper[1]. The *Model 5* cell shown in Fig. 1 has 2 chambers between which the test specimen is installed in a 12-in. diameter ring. In one chamber, a water container hangs on a calibrated spring balance. In the other, a desiccant container is similarly supported. In each chamber, a fan circulates the air and assists in the maintenance of the chosen relative humidity. These fans are driven through magnetic couplings by external motors. Control of relative humidity is accomplished by an electric hygrometer and associated electronic equipment. For these tests, the cells were placed in a temperature controlled room, providing isothermal test conditions. These arrangements insure a well defined vapor pressure difference across the specimen. The rate of moisture transfer is obtained by periodic readings of the spring extensions. When the rate of loss from the water source matches the rate of gain in the desiccant sink, a steady state exists, and test results are valid. Only steady-state conditions are here considered.

The schedule for each specimen required first a test of its permeance with no unbalance of total pressure across it. Subsequently, tests were made with a *positive* unbalance (in the direction of vapor pressure difference) and then with a *negative* unbalance. The total unbalance ranged up to 4 in. water pressure and required a wire grid support for some specimens. In all tests, it is convenient to relate the vapor transfer rate to the vapor pressure difference using Equation 1. For distinction, the value of M with unbalanced total pressure is called *apparent permeance*.

To provide this unbalance of total pressures, 2 methods were employed, the unbalance being measured by an inclined differential manometer.

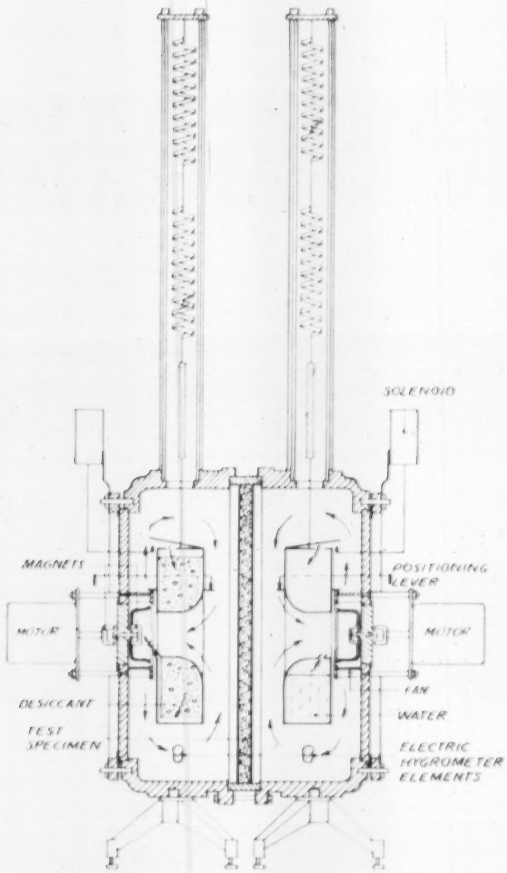

Fig. 1—Model 5 Banjo Cell

1. The *closed* method was used when the specimen was not porous to air. It required only a small charge of excess air in 1 cell chamber or the other at the start of the test.

2. In the *circulating* method, air was supplied at low pressure to 1 chamber and discharged out of the other to waste. However, the supply air was thoroughly dried before entrance and the exit air was also dried before wasting. In the former case, no water was added to the system. In the latter case, the drier is considered a part of the system and its water pick-up included in the calculation. For dependable and equal drying of supply and discharge, 2 or more driers on each side were connected in series. Each contained a desiccant and any appreciable gain in the last of the series was a signal for changing the desiccant in all.

The air porosity of each specimen was measured before and after each permeance test in a separate apparatus using a water displacement technique. The second measurement was required to detect any damage to the seal of the specimen in its mounting that might have occurred during the test. Within the limited range of air pressure utilized, the air flow rate for each specimen may be considered proportional to the pressure difference, the factor being its *porosity coefficient*, expressed in Table 1 as grains of dry air per (square foot) (hour) (inches H_2O).

Results

Five materials were tested as shown on Table 1, but only the results from the first 4 are reported in full. The air porosity of 2 was nil or slight and of the other 2 was relatively high. In all, 46 separate tests were made. The results of 29 are shown in Fig. 2 with the apparent permeance plotted against total pressure difference. It is immediately evident that the permeance of cellulose acetate was unchanged in the range of pressure applied, while the apparent permeance of the porous 15 lb roofing felt increased as much as 25 fold when the total pressure difference was positive. Naturally, the effect of negative unbalance was less conspicuous.

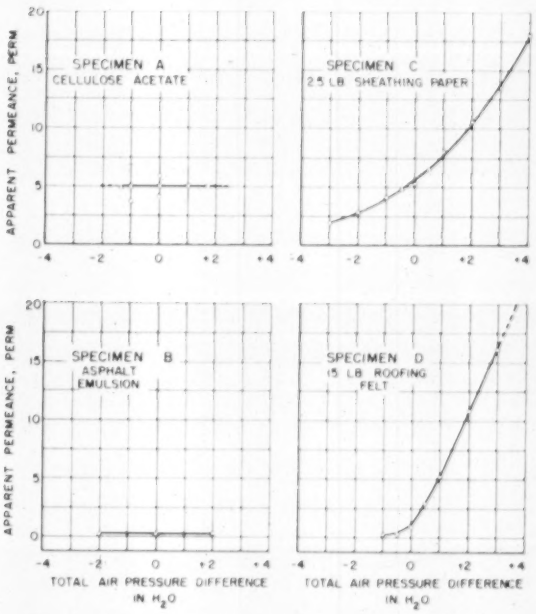

Fig. 2—Apparent Permeance of Four Sheet Materials

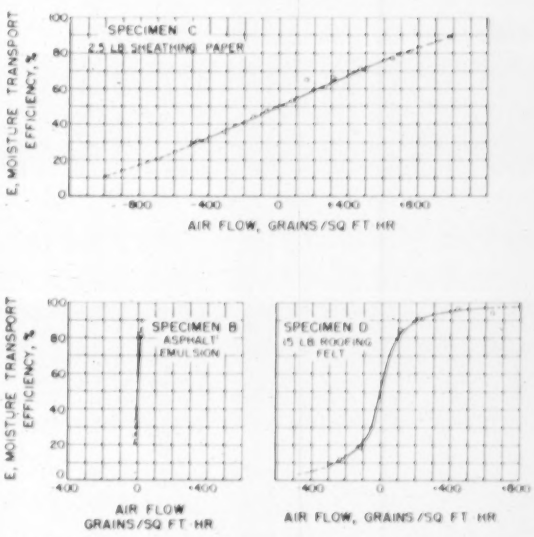

Fig. 3—Efficiency of Moisture Transport by Air Flow Through Porous Sheets

The results indicate that the permeance is affected by air flow and not by air pressure, per se, in the test range. It also appears that the effect of air flow is sometimes so large that the simple coefficient, *apparent permeance*, is not a desirable way to express this effect.

For the porous sheets, the air flow may be considered largely a mass movement and the moisture transfer treated as consisting of 2 parts: (1) the normal vapor diffusion; (2) the transport of vapor by mass air flow as expressed in Equation 2, thus:

$$W = M_n \Delta p + PA' \quad \ldots\ldots\ldots\ldots (2)$$

where

W = total vapor transfer in grains per (square foot) (hour).

M_n = normal permeance (with balanced total pressures).

Table 1—Specimen Materials and Test Conditions

Specimen and Description	Air Porosity grains dry air per (sq ft) (hr) (in. H_2O)	Test Conditions Temp. F	Percent RH source	Percent RH sink	Permeance with balanced press. perms	Test Method
A. Cellulose Acetate, 10 mil sheet	0.00	70	50	25	9.1	closed
B. Asphalt Emulsion* 1/8 in. coat on 3/4 in. cork board	0.27	70	90	1	0.30	closed
C. 2.5 lb Sheathing Paper, asphalt infused kraft	157.	70	50	5	5.5	circulating
D. 15 lb Roofing Felt, asphalt saturated, 15 lb per 100 sq ft	220.	70	75	5	0.85	circulating
E. Cement Asbestos, 1/4 in. board	0.14	70	74	1	2.0	circulating

*Sand filled clay type asphalt emulsion, trowelable grade.

F = air flow rate (dry air) in grains per (square foot) (hour).

h' = *effective moisture content* of the air flow in grains per grain of dry air.

Letting h = the actual moisture content of the air on the side of higher vapor pressure and putting $h'/h = E$, we have:

$$F = GE - M\Delta p_t/Eh \quad \ldots\ldots\ldots (3)$$

In this form, E is a ratio expressing the efficiency of the air flow as a carrier of vapor. Naturally, $E = 1$ for positive air flow through an orifice.

In any test, all factors on the right side of Equation 3 are known and E can be found. This has been done for Specimens B, C, and D. (Specimen A has zero air flow and E is indeterminate). The ratio is plotted in Fig. 3.

The significance of this ratio, E, is evident when the air flow is positive (same direction as vapor pressure). For negative air flow, E is still positive but its physical meaning is less clear. However, by relating all test results to the same base, their correlation is continuous through zero air flow, facilitating analysis.

In Fig. 3 for positive flow, E ranges up to 1.0 as a limit, indicating that the efficiency of air as a vapor transport is lower in a porous medium than in a simple orifice. This appears to be due to loss of freight from the carrier along the way. It indicates that the 2 mechanisms — diffusion and transport — are not independent, confirming the principle stated earlier.

On the negative side, the same inter-relation is seen. The counter-flowing air, starting essentially dry, picks up moisture along the way until it emerges with a substantial load — larger per unit of air when its flow is small. It will be noted that the tests did not show a net vapor transfer against the vapor pressure gradient. Of course, this would be unlikely with the low-side vapor pressure that existed. With higher vapor pressure on the low-side, negative air flow would have a higher efficiency and readily transport more vapor than could diffuse against it, thereby providing a net transfer counter to the vapor pressure gradient.

Comparing one material with another plotted on the same scale in Fig. 3, marked differences are seen. For Specimen C, 2.5 lb sheathing paper, the efficiency increases slowly and smoothly throughout the range of air flow, suggesting an intimate inter-relation with the diffusion mechanism. This material is believed to have very small but innumerable air paths. In contrast, for Specimen B, 1/8 in. asphalt emulsion on cork-board, the transition from negative to positive air flow is sharp. This result suggests that the air paths are few and essentially orifices; possibly defects in the sheet. There is little chance for inter-connection with the vapor diffusion mechanism. In Specimen D, 15 lb roofing felt, the effect is intermediate; suggesting a coarse structure open to air flow.

These results are significant in practical vapor control problems. Where a vapor barrier membrane is placed in a wall cavity, air movement around the margin of the membrane or through joints or tears in it, is a potent means of vapor transport. Such air movement entirely within a wall cavity invariably has the net effect of carrying moisture to the zone of lower vapor pressure and possible condensation.

On the other hand, air that moves into a wall structure from a drier (colder) source may be expected to remove moisture from the structure when it leaves. Practical application of this principle is found in house walls properly vented to the weather. Similarly, attempts have been made to apply this principle to cold room walls vented to the cold space.

In any structure, it appears possible to develop slight pressure by introducing adequately dry air into the cold side of the assembly and thereby reduce vapor entrance through a vapor barrier and especially through its defects. Of course, the economics of such applications involve the altered heat transfer through the structure and, in the case of a cold room, the need for cooling the air supply.

Conclusions

1. The diffusion of water vapor through a membrane is not affected by a small unbalance of the total air pressure across it when no air transfer results.

2. When air passes through a membrane because of wind or other small unbalance of pressure it carries moisture with it. When the air flow is in the same direction as the vapor pressure gradient it increases the moisture transfer. When opposite, it reduces the moisture transfer and may reverse it.

3. Air, filtering through a porous membrane in the same direction as the vapor pressure gradient delivers less moisture than the same air quantity blowing through a hole or crevice; but air flow opposite to the vapor pressure gradient delivers more moisture through a porous membrane than it could through a hole or crevice.

4. Air flow, through or around, a vapor barrier in the same direction as vapor pressure can seriously reduce its effectiveness.

Acknowledgment

This report and 2 others planned for early publication are based on work done in the Thermal Research Laboratory at The Pennsylvania State University under the sponsorship of the Armstrong Cork Co. F. M. Cavan and R. J. Calvert, representing the sponsor, have contributed much to its accomplishment.

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INTERMITTENT GROUND GRIDS FOR HEAT PUMPS

By G. S. Smith* Seattle, Wash.

SUMMARY: Since the heat pump provides a means of recovering solar heat, heat sources for this device become more and more important. Although the ground grid is by no means the cheapest or even the best source, nevertheless it is, when properly designed, a dependable source, and may often prove to be the best available source.

Experimental studies, made when using the ground coil under intermittent operation and simulating normal heating use, appear to provide information of most value. This paper in a brief way presents the results of one further test of this type; makes some comparisons with 3 other reported tests of a similar nature; and gives the results of studies on some of the more troublesome factors involved. It stresses the need for an adequate compilation of all available data for future use in design and also calls attention to the need for more careful and detailed studies on some of the factors still in question.

SEVERAL studies have been made on the use of ground grids as a source of heat for the heat pump. Some were purely theoretical[1,2] studies using reasonable assumptions for the prevailing conditions and variables involved, others were partly or entirely experimental in nature,[3,4] and reported actual operating data. In comparison, these last included only a few tests in which the operation was intermittent to simulate operation under actual heating conditions.[3,5]

All of the studies have greatly assisted in an understanding of the various factors involved and have provided information useful for design purposes. However, because of the multitude of variables to be considered, many of which are difficult to determine, no method of design has been proposed that is not finally dependent upon a careful analysis of the proposed design in the light of all reported information from actual tests, or from successful installations. Perhaps no definite prescribed method of design will ever be found that will not depend to a large extent upon the use of such accumulated information. Thus such compilations of data would seem to be imperative, and should include as much detailed information of existing conditions, design factors, and even operating results as would seem to bear directly upon the problem.

Studies, both theoretical and experimental, have been made at the University of Washington, and some of the results have been reported.[3,5] A more recent series of tests were made during the heating season of 1952-53 in which the heat pump operation followed the intermittent heating requirements demanded by the weather.

Intermittent Tests At University of Washington

To determine the time for operating the heat pump each day, the total operating time for each month was calculated and a portion of this time allocated to each day in such a way as to cover a wide variety of running periods, from a very brief run to almost continuous operation for the whole 24 hr of the day. The monthly operating time was based upon the predicted average coldest day of the year. This average coldest day was determined by taking the degree days for the average coldest day for a number of years picked at random from the last 50 years of records. Assuming that the heat pump would operate almost continuously on such a day, the monthly operating hours were calculated as follows:

Operating hours per month = Hours in month × percent of operating time.

The percent of operating time is the ratio of the average degree days for that month divided by the product of the days of the month and the degree days of the average coldest day as just mentioned. This will closely approximate the average intermittent operation under actual heating conditions.

The ground grid used for these tests consisted of one loop of ½ in. O.D. copper tubing, with an effective heat collecting length of 150 ft. It was placed 1 ft below the surface, with the 2 sides of the loop spaced 1 ft between centers.

The soil was sandy with some gravel and a little fine material approaching the nature of clay. Its casa grande classification would be S.W. with a dry weight of 97 lb per cu ft. Other details of the soil characteristics are given in No. 8 of Table 1.

A 2-hp motor and suitable compressor was used as a heat pump. Dichlorodifluoromethane was expanded directly into the ground grid by means of a thermal type of expansion valve. All important temperatures and pressures, as well as the refrigerant flow while in its liquid stage, were photographically recorded every 5 min. The average of the 12 readings per hr was used for computations. Fig. 1 shows an enlarged print of one of the frames of the records taken.

The scheduled program of extracting heat was started November 1 but continuous records were not started until the recording apparatus was finally made available on December 1. The run was continued through until the last of March except for approximately 1 week in December

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[1] Exponent numerals refer to References.

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when, because of a burned out bearing, a new compressor was installed. The effectiveness of the heat withdrawn was compensated for by running longer periods for the remainder of the month.

Results from Intermittent Tests

The relation of the average final value of Btu/(hr)(ft)(F deg), which will be termed Q', and the length of the run t is shown by the curves in Fig. 2, as determined by all the various runs taken during each month. The temperature difference was taken as the difference between the average refrigerant temperature in the grid as an evaporator, and the undisturbed soil temperature at the same depth and about 25 ft away so as not to be affected by the grid. The curves for each succeeding month were lower than those of the previous month because the average temperature of the general soil volume was decreasing. This trend would reverse as soon as the heat due to the spring weather could penetrate to the grid depth. The minimum undisturbed soil temperature at a depth of from 4 to 6 ft usually occurs from the latter part of February to the first part of March.

The curve for the averages over the heating season included the higher values for November and December which were not derived in enough detail to be included as separate curves.

Fig. 3 gives the average soil moisture at the grid depth during the season. The autumn weather was rather dry, but the rainfall during January was unusually high. With rainfall normal for November and December, the earlier curves would have been somewhat higher. Rainfall during the heating season adds greatly to the available ground heat. During a rain the air, and thus the water temperature, is always well above freezing, and because of its high specific heat the water carries a considerable amount of heat into the soil. Soil moisture was measured by commercial glass fiber soil-moisture cells.

As the run progressed, a cylinder of frozen soil formed about the tube and increased to a radius of about 6 in. There is a tendency for frozen soil to slightly increase its thermal conductivity as the temperature decreases. This frozen cylinder would then tend to increase rather than decrease the heat withdrawal effect.

In addition to this the frozen cylinder provides an apparent heat storage effect, since at freezing temperature the latent heat of freezing is released with no change in temperature gradient thus adding to the heat withdrawn while the pump is running. During the time when the heat pump is not in operation this somewhat enlarged cylinder continues to extract heat from the surrounding warmer soil, replacing the latent heat with no change in temperature until the latent heat is all restored and the soil is no longer frozen.

The curves in Fig. 2 show a rapid decrease in Q' during the first 2 or 3 hours of operation but after that time the heat flow into the tube approaches a more nearly constant value. The heat extraction factor Q' is below that calculated by theory, as can be seen by comparing the Q' at 10 hr in Fig. 2 with that for 10

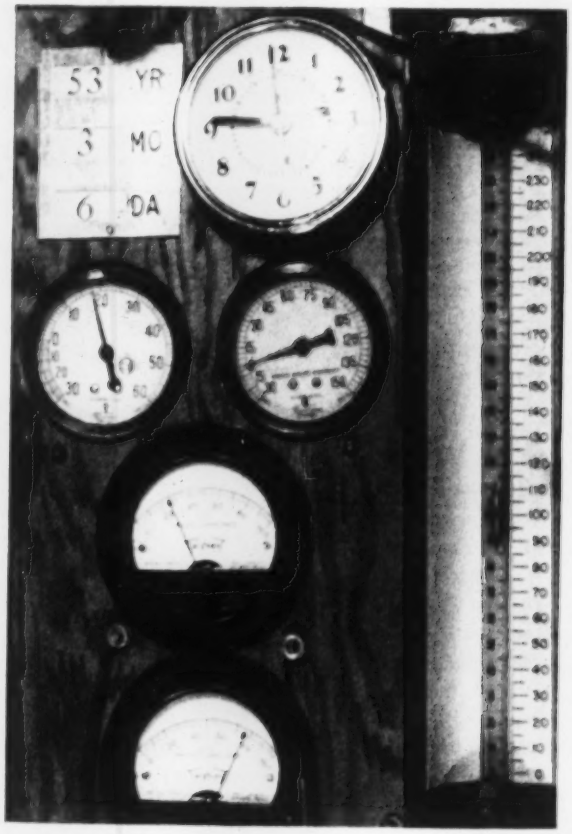

Fig. 1. Simple expedient of photographed data

Nomenclature

- B = Btu per hour.
- Q = Btu per (hour) (foot).
- Q' = Btu per (hour) (foot) (Fahrenheit degree)*.
- q = Btu per (hour) (square foot) (Fahrenheit degree)*.
- t = temperature Fahrenheit.
- r = tube radius in feet.
- r_1 = distance in feet from center of tube to point of temperature T_1.
- r_2 = distance in feet from center of tube to point of temperature T_2.
- l = tube length in feet.
- k = thermal conductivity, Btu per (hour) (foot) (square foot) (Fahrenheit degree).
- α = thermal diffusivity = k/cp, square feet per hour.
- ρ = density = pounds per cubic foot.
- β = spacing ratio = Z/r.
- Z = spacing between tube centers in feet.
- θ = time in hours.
- h = film coefficient—Btu per (square foot) (Fahrenheit degree) (hour).
- n = number of parallel tubes used in a grid.

*Fahrenheit degree temperature difference is that between refrigerant in evaporator and the normal undisturbed soil except for the Philadelphia Electric Co. tests where the tube temperature only was given.

hr in Fig. 5, on curve for University of Washington Soil Sample No. 8.

This 150 ft loop of grid supplied a minimum of about 4000 Btu per hr. When the soil was reasonably moist due to the rainfall in January, the rate ranged from 4300 to 5000 Btu per hr. With a spacing greater than 1 ft the grid would have supplied a small amount more, but at a smaller spacing the decrease would have been even more noticeable. With several tubes in parallel at the same depth and spacing, a further decrease would result. However, the tests indicate that the earth does provide a dependable source of heat providing enough volume is drawn upon not to decrease the average temperature of the volume below 35 or 40 F. Freezing any large percentage of the soil volume will not greatly increase the amount of heat obtained and may prove very destructive if building foundations are nearby.

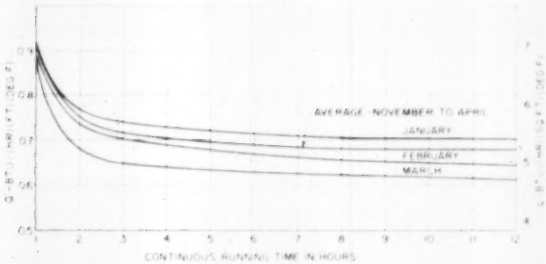

Fig. 2. Heat transfer characteristics of ground grid from University of Washington intermittent tests.

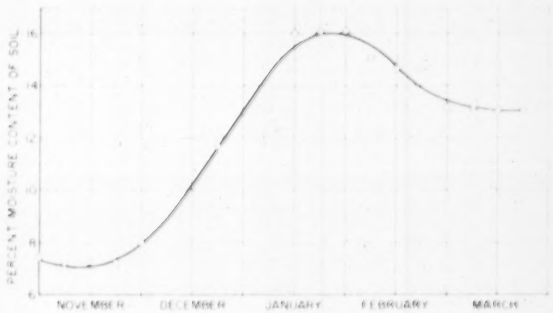

Fig. 3. Soil moisture taken at four foot depth University of Washington intermittent tests.

Comparison with Similar Reported Tests

Since considerable detailed information on 3 other similar tests was available, studies for comparing results were made. The complete set, or even an abbreviated set, of the computed values for comparison cannot be given here. However, Table 2 does give the overall average, high and low values for each set which at least indicates a fair correlation of results considering the diversity of the factors involved such as the tube size, soil properties, and refrigerant temperatures.

In obtaining the values for University of Kentucky, the so-called normal soil temperatures were taken as the temperature 13 in. below the coils since this appeared to be the best temperature at any distance that was given. The actual normal soil temperature was doubtless somewhat higher in general. In these tests the grid source gives a considerably lower rate of heat transfer than for the line source. The greater values of heat transfer for 1949-50 as compared to those for 1952-53 might be accounted for by the greater rainfall in the 1949-50 season.

For the Philadelphia Electric results, the evaporator coil temperature was used instead of the actual refrigerant temperature because the latter was not given.

In general the high and low values are often extreme because they may have been unusual, such as records at the start before average conditions prevail, or under abnormal conditions existing at times but not observed or at least reported. The average values should, however, be representative for such comparisons.

Table 3 gives additional data of a similar nature. In most cases these tests were of single continuous runs of various time durations, but they show very similar results. Tables 2 and 3 give only a small portion of all the results available, but a more extensive set of data would reveal very little additional information.

Determination of all the reasons for the variations in the tests considered would probably be next to impossible. However, further study of a few of the major factors involved might be of value. Results of these additional studies will be presented with the hope that they will be of value to designers and perhaps inspire more extensive compilations of results, as well as new and more extensive studies.

Soil Properties

If the designer could arrive at some value of thermal conductivity, K, of the soil about the grid with no complications due to surface films or other irregularities, and the soil body could be assumed an infinite uniform medium, his task would be comparatively easy. Even then, to arrive at a reasonably accurate value of K would probably require tests or at least a good knowledge of K values for similar soils.

A considerable amount of careful and detailed work has been done on the thermal properties of various soils under many varying conditions. A rather extensive and detailed compilation of a major portion of such reported work would enable a designer to select a K value for his soil as accurate as is necessary for his purposes. He must still determine the soil type, the approximate natural density, and the average moisture content. A very brief table of such results is presented in Table 4, in which references to the sources are given. By referring to these and other reports, a more extensive set could be easily assembled.

From this table it is apparent that the soil conductivity varies from

about 0.25 to around 2.25, with the greater portion running around 0.75 to 1.00. The effect of moisture is very evident. Sand is usually superior to clay since solid quartz has a higher thermal conductivity than water. Dry sand is poor because of the air voids between grains, but dry clay is even poorer than sand. In general clay will hold large percentages of water, tending to give it a K factor dependent largely upon the moisture present. Sand will usually hold sufficient moisture to effectively fill the voids. The moisture of soils at usual grid depths is normally almost constant, but varies noticeably with long dry or unusually wet spells.

Film Coefficients

In the design of a heat exchanger the effect of the infinitesimally thin films just inside and just outside the metal surface must usually be taken into account. Such effects are also present in ground grids but have usually been given little or no attention. Film coefficients are in general very difficult to determine and often vary over wide ranges. In this respect the ground grid is no exception. During earlier work at the University of Washington some special tests of this nature were made and mentioned in reference 4. The results of these tests were far from satisfactory and were not included. However they definitely indicated film effects present and compare reasonably well with the studies to be given here.

The theoretical temperature difference between any 2 points outside of a heated or cooled tube in an infinite uniform medium and where no end effects are present can be expressed by the equation.

$$T_2 - T_1 = IU \log (r_2/r_1)/2\pi IK1$$
$$= IQ' \log (r_2/r_1)/2\pi K1 \quad \ldots (1)$$

Thus a plot of actual temperature at varying distances from the center of an isolated tube should be a straight line if the distances are plotted on a log scale against temperature on a uniform scale. Solving Equation (1) for K indicates that the thermal conductivity of the soil can be determined and that it is proportional to the slope of the temperature difference between 2 selected points on the straight line curve.

Most of the intermittent tests studied contained sufficient measured temperatures and other information

Table 1—General data on grids used in intermittent run tests in Tables 2 to 5.

Tests by	Tube O.D. in.	Outside Tube Area, Sq ft/ft	Active Tubes: Length in ft	Active Tubes: No. in Parallel	Spacing ft	Refrigerant used*	Soil No.	Depth below Surface, ft
Univ. of Washington	1/2	0.13	150.1	2	4	A	8	4
Univ. of Kentucky	1 1/8	0.294	170	1		B	7	5 to 5.6
Univ. of Kentucky	1 1/8	0.294	347.1	9	4.75		7	4 to 5
Comm. Edison Co.	1 1/8	0.425	155	2	10	A	9	6
Phil. Elect. Co.	1 1/2	0.500	Variable	2	1.25	B	5	5

*A — dichlorodifluoromethane; B — antifreeze mixture.

Table 2—Average high and low values of several of the important factors reported on the various tests specified in Table 1.

	Tests by	Year	Hours Running Time	Normal Soil Temp, F	Avg Refrig. Temp, F	Q' Btu per (hr) (ft) (°F deg)	q Btu per (hr) (sq ft) (°F deg)	Other Factors
Avg	Univ. of	'52	10.5	49.5	6.66	0.707	5.45	
High	Wash.	and	24	51.0	8.58	0.799	6.15	
Low		'55	4	49.0	5.82	0.595	4.58	
Avg	Univ. of	'49	12	46.0*	25.3	2.14	7.28	Line
High	Kentucky	and	12	60.9	35.2	5.98	20.5	Type
Low		'50	12	40.6	16.5	1.14	3.88	Source
Avg	Univ. of	'49	12	46.0*	25.9	0.784	2.67	Grid
High	Kentucky	and	12	60.9	35.8	1.64	5.58	Type
Low		'50	12	40.6	17.2	0.425	1.45	Source
Avg	Univ. of	'52	12	47.4*	13.7	0.936	3.19	Line
High	Kentucky	and	12	62.0	27.1	1.78	4.35	Type
Low		'55	12	58.4	8.0	0.614	2.05	Source
Avg	Univ. of	'52	12	47.4*	14.4	0.420	1.43	Grid
High	Kentucky	and	12	62.0	24.5	0.647	2.20	Type
Low		'55	12	58.4	8.88	0.318	1.08	Source
Avg	Comm.	'47	10.3	51.0	19.5	2.08	4.9	
High	Edison	and	17.5	60.2	23.0	3.15	7.65	
Low	Co.	'48	1.0	45.4	17.6	1.40	3.30	
Avg	Phila.	'48		53.4	41.0	1.60	5.20	Actual
High	Elect.	and		64.7	70.3	6.60	13.20	Residence
Low	White marsh	'49		45.4	29.6	0.44	.88	Heating
Avg	Phila.	'48		53.9	40.6	1.46	2.92	Actual
High	Elect.	and		64.5	64.0	3.10	6.20	Residence
Low	Lands downs	'49		47.5	28.0	0.85	1.66	Heating

*Normal temperatures given here were at 18 in. below coil; temperatures at surface of ground coil in this case.

Table 3—Data from Miscellaneous Tests Both Continuous and Intermittent Over Limited Periods

Tests By	Tube O.D. or Diam	Length ft	Depth ft	Spacing ft	Soil Type	Avg Tube Temp	Avg Soil Temp	Hours run	Q' Btu per (hr) (ft) (°F deg)	q Btu per (hr) (sq ft) (°F deg)
Univ. of Conn.	2*	150	6			50.0	45.8	648	2.29	10.0
	2*	150	6			48.0	47.0	719	1.70	7.3
	1 1/2	150	8			48.5	41.7	600	2.10	5.8
Kan. State Col.	1 1/8	100	6	2	Sandy	55.0		400	1.68	5.7
	1 1/8	100	6	10	Sandy	51.0		400	2.43	8.2
	1 1/8	100	6		Sandy	50.8		670	1.16	3.9
	1 1/8	100	6		Clay	50.0		6 on 6 off	1.25	4.2
	1 1/8	100	6	A	Sandy	50.0		6 on 6 off	1.42	4.8
	1 1/8	100	6	A	Clay	50.0		6 on 6 off	1.45	4.9
	1 1/8	100	6	A	Sandy	50.0		163	1.01	3.4
	1 1/8	100	6	A	Clay	50.0		Cont.	1.31	4.4
Southern Research Institute	1 1/8	88	3	A	Sandy	54		260	2.55	8.6
	1 1/8	88	3	A	Clay	54		260	2.15	7.3
Texas A and M	1	100	5	10				Variable	1.01	3.7
Util. Res. Commission	1 1/8	155	6	10	Clay	18	43	Variable	1.70	4.0
	1 1/8	155	2	10	Clay	18	43	Variable	1.40	3.3

*A — 1/2 in. tube inside of 1 1/8 in. tube.

to enable the plotting of such curves. Three of such curves are shown in Fig. 4. The direction of the measured temperatures was taken to avoid the effect of adjacent grids as much as possible. For the University of Kentucky, the temperatures at 6, 12, and 18 in. directly below the grid were used. In others, the temperatures at horizontal distances at the grid level in a direction away from other tubes were used.

Table 4—Soil Properties from Various Reports

No.	Location	Casa Grande Symbol	Soil Type	Liquid Limit	Plastic Limit	Dry Density ρd	Spec. Heat, s	Thermal Diffusivity, α	Moist. % Dry wt	Therm. Cond. K	Reference
1	Columbus, Miss.	S.C.	Clay Sand			107.1	0.165	0.029 0.038 0.045 0.046	5 10 20 30	0.66 1.06 1.74 2.28	10
2	Cleveland, Tenn.	O.L.	Sandy Silt	28.6	23.4	94.5	0.149	0.018 0.022 0.024 0.022	5 10 20 30	0.33 0.52 0.80 0.94	10
3	Bristol, Va.	M.H.	Silty Clay	55.1	39.6	75.3	0.195	0.011 0.012 0.015 0.016	5 10 20 30	0.17 0.27 0.43 0.60	10
4	Jackson, Tenn.	C.L.	Lean Clay	46.7	26.3	84.5	0.207	0.012 0.014 0.017 0.018	5 10 20 30	0.26 0.35 0.59 0.76	10
5	Decatur, Ala.	C.L.	Lean Clay	29.0	21.3	86.3	0.176	0.018 0.024 0.024 0.024	5 10 20 30	0.38 0.57 0.85 0.91	10
6	Paris, Tenn.	C.L.	Lean Clay	49.6	25.2	85.3	0.188	0.011 0.013 0.017 0.018	5 10 20 30	0.22 0.41 0.55 0.74	10
7	Lexington, Ky.	C.L.	Lean Clay	43.4	27.3	95.0	0.20	0.019	26	0.84	10
8	Seattle, Wash.	S.W.	Sand Gravel			97		0.036	14	0.73	11
9	Comm. Ed. Ill.					110		0.0789	18	1.70	5
11	Dakota Co., Minn.	S.M.	Sandy Loam			110			4 10	0.45 1.08	5
12	Ramsy Co., Minn.	C.L.	Sandy Loam			110			4 10	0.54 0.85	5
13	Northway, Alaska	M.L.	Silt Loam			90	0.176		10 20	0.35 0.50	5

Table 5—Results From Studies of Effect of Tube Surface Films

Date	Thermal Conductivity Actual K	Thermal Conductivity Apparent K_a	K_a / K	Film Δt	Film Coef. F in Btu per (sq ft) (hr) (°F deg)	Avg. Tube Temp.
From University of Kentucky Tests						
11-4-52	1.050	0.485	0.470	27.0	3.8	18
12-2-52	0.790	0.450	0.545	24.5	5.5	14
1-15-53	0.605	0.345	0.572	19.2	5.16	13.5
2-13-53	0.618	0.328	0.532	21.6	2.84	9.5
3-2-53	0.637	0.344	0.540	19.7	5.16	10.4
4-1-53	0.900	0.420	0.466	20.5	5.38	14.0
From Commonwealth Edison Tests						
12-10-47	2.17	1.68	0.775	8.5	21.8	19
1-14-48	1.62	1.41	0.870	5.9	30.0	18
2-1-48	1.25	1.19	0.950	1.5	72.5	19.4
2-19-48	1.78	1.47	0.827	3.0	122.6	20
3-1-48	1.69	1.62	0.960	1.5	94.0	18.9
4-1-48	1.62	1.50	0.925	2.5	52.8	20.0
4-10-48	2.14	1.91	0.937	2.6	55.5	20.0
From University of Washington Tests						
1-16-53	0.915	0.715	0.780	9.95	24.0	8.0
2-1-53	0.785	0.660	0.840	9.56	25.1	5.8
2-22-53	0.825	0.655	0.767	10.40	22.0	6.0
3-5-53	0.770	0.602	0.780	9.70	23.6	5.50
3-19-53	0.765	0.585	0.855	8.0	27.5	5.25
3-27-53	0.670	0.604	0.900	6.85	33.7	5.50
From Philadelphia Electric Tests Whitemarsh						
2-22-48	1.100	0.94	0.855	1.7	18.5	35.0
11-30-49	0.910	0.94	0.945	1.5	57.0	30.9
12-21-49	0.995					
2-21-50	1.240					
Landsdowne						
12-20-49	1.35	1.11	0.855	1.6	54.0	29.5
11-15-49	1.24	1.00	0.810	1.7	29.0	50.0
1-17-50	1.08					52.0
2-21-50	1.42	1.09	0.84	2.6	29.1	26.9

Journal Section

By projecting the straight line to the tube radius in the plot, the temperature difference between this intersection and the average refrigerant temperature within the grid is a reasonably accurate indication of the film effect. With q known the film coefficient h (inside plus outside) will be

$$h = q/t_f \quad \text{Btu per (hr) (sq ft) (F deg)} \quad \ldots\ldots\ldots\ldots (2)$$

To use this factor the designer must calculate the heat flow due to a composite temperature difference made up of the temperature across the tube films using the film coefficient h involving zero distance, and the resulting temperature gradient within the soil with its thermal conductivity factor K. Perhaps an easier method could be proposed that would be almost as accurate in most cases by using a value of K decreased in value to account for the film effect. Such possible multiplying factors will be derived as follows.

By selecting 2 distances from the center of the tube, say 6 in. and 30 in., the temperature difference on the solid line, which is the actual temperature gradient within the soil, can be used in Equation 1 to find the true K for the soil as indicated by this actual temperature gradient. By drawing a straight line from the 30 in. point to the average refrigerant temperature at the tube radius, the temperature difference between 6 and 30 in. can again be found on this straight line. This is shown by the dash lines in Fig. 4. Using this apparent temperature difference in Equation 1, an apparent value of K can be found which will be designated K_a. The ratio of K_a to K will give the ratio by which the K of the soil should be decreased to give results equivalent to the actual conditions. The distance of 30 in. was chosen as a reasonable distance beyond which the soil temperature would probably be constant, regardless of the grid operation. Because of the nature of the log scale used

for distances, doubling the 30 in. dimension would produce only a very small decrease in the apparent slope thus derived. The choice of 30 in. rather than 60 in. or more results in a greater factor of safety in design constants.

Table 5 gives a number of both K_s/K and h values determined by this method. Each set was calculated from the data reported for a given day of operation, and again selections were made at random, or in some cases, only where sufficient data were available. As might be expected from comparisons of previous results, these results are variable. While no claim can be made that the method or results are highly accurate, the study does definitely indicate the need for some means of accounting for this factor, and the figures presented can serve as a guide in estimating the effect. More careful studies on this feature would be of considerable value in the design of ground grids.

Effect of Tube Size

The effect of the tube size on the amount of heat extracted has often been mentioned but to the author's knowledge few if any specific figures or curves have been presented. For that reason a set of several types of soils were selected, including those for 3 of the tests reported, and the values of Q' and q were calculated. Calculations were made using Ingersoll's method, assuming a single isolated tube. Sizes from $\frac{1}{2}$ in. to 3 in. were included, and continuous runs of 10 as well as of 16 hr were used. Fig. 5 gives the results in curve form for q plotted against the tube sizes. The Q' value is merely the product of q and the external square foot area of the tube per foot of length.

These plotted values are higher than those obtained by tests in Tables 2 and 3 because ideal conditions were assumed. However the relative values for the various tube sizes should be accurately indicated by the curves.

Evidently the smaller tubes are more effective per unit of area than the larger ones. This is not surprising since the soil volume drawn from is not appreciably different, and the larger area presented by the larger tube becomes less effective per unit of area. However, the pressure drop of the circulating liquid or gas must be maintained at a reasonable value, and this can be accomplished either by the use of a larger tube or by several tubes used in parallel. The latter choice often gives trouble in distribution of flow and is usually avoided or overcome only by the use of an individual expansion valve or a circulating pump for each of the parallel circuits.

Effects of Spacing of Tubes in Grid

Still another factor that has been given too little attention is the effect of proximity of the tubes in the grid. A set of calculated curves is presented in Fig. 6. The plot shows 4 sets of curves where the full-line curve is calculated for 3 parallel tubes in a grid, while the broken-line curve is for an infinite grid. Most actual grids will fall between these two. Each set was calculated for a specified ratio of spacing between the centers of tubes to the radius of the tube. The coordinates are the ratio of Q'_n/Q'_1 *vs* $A\ t$. Here Q'_n is for a grid consisting of n tubes in parallel, while Q'_1 is for a single isolated tube. The constant A is equal to α/r^2 where α is the diffusivity of the soil and r the radius of the tube in ft, while t is time in hours of continuous operation. Such curves can be used with any type of soil or for any tube size. By having these 2 factors specified, the time in hours at any point on a specified curve is easily determined with reasonable accuracy. However the relation between line and grid sources given in Table 2 appears to give greater differences than were indicated by the calculated curves, and

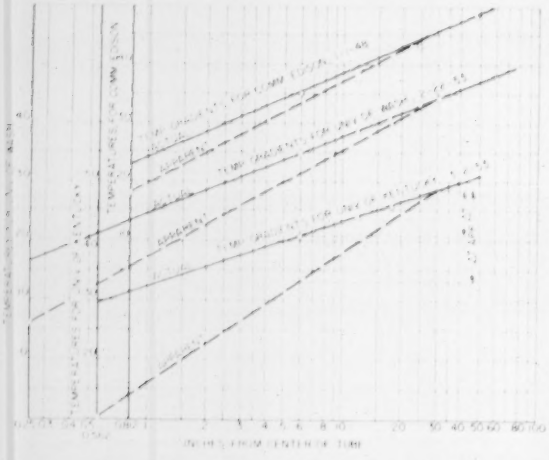

Fig. 4. Temperature gradient plots for studies on film coefficient effects.

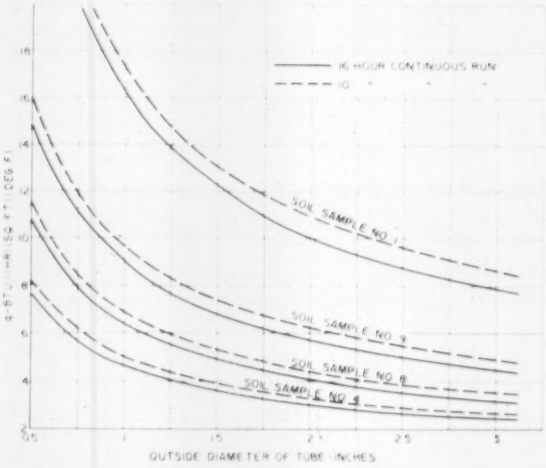
16 HOUR CONTINUOUS RUN
10 " " "
SOIL SAMPLE NO 1
SOIL SAMPLE NO 2
SOIL SAMPLE NO 3
SOIL SAMPLE NO 4
OUTSIDE DIAMETER OF TUBE - INCHES

Fig. 5. Curves showing relation of outside diameter of tube to its heat transfer factor q. Curves calculated by means of theoretical equations.

here again more information from actual tests would be desirable.

Use of Information for Preliminary Estimates or Designs

No design procedure has been suggested since this could well be the topic of a more extensive paper, and because several proposals have already been made.[5, 13, 14] However, a suggestion as to the use of such compiled information, as is briefly presented here, in making preliminary estimates on a grid design might be of value. With a well selected compilation of such data to cover almost any proposed set of conditions, such methods may later prove to be adequate for final design.

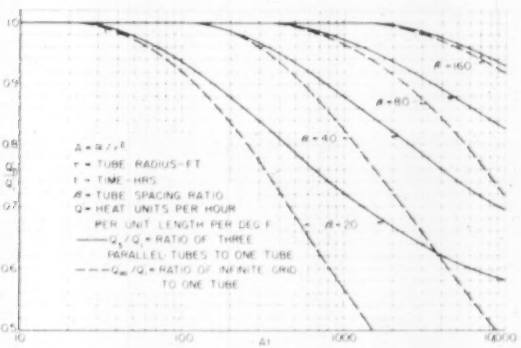

Fig. 6—Heat transfer coefficient ratio curves calculated by means of theoretical equations

Problem: Assume a residence requiring 50,000 Btu per hr, using a heat pump with a C.O.P. of 3. The necessary heat to be extracted from the heat source would be 2/3 of the total heating load or approximately 34,000 Btu per hr. Let further assumptions be as follows: soil type that of No. 2 in Table 4, having an average moisture content of 21 percent, and thermal conductivity, K, of 0.73 at the final grid depth; evaporator grid made of 1 in. outside diameter tubing; probable lowest mean soil temperature in February of 40 F; average refrigerating temperature, to promote some freezing, 12 F; average temperature difference, 28 F.

Solution: The soil type and other conditions correspond fairly closely to the University of Washington tests with an average q of 5.43. Since this was obtained with a ½ in. diameter tube, the ratio of q for a ½ in. to a 1 in. tube after running 10 hr can be found in Fig. 5 and is approximately 0.6. Thus the 1-in. tube would give a q of about 5.43×0.6 or 3.26, and since its outside area is 0.262 sq ft per ft, the Q' value will be 0.854. Since the temperature difference was 28 deg, the Btu per hr per ft of tube is 23.9. Thus the 34,000 Btu heating load would require about 1430 lineal ft of tubing if so spaced that they do not appreciably affect each other.

Assuming a 4-ft spacing the mutual effect between adjacent tubes could be approximated by using Fig. 6. Thus β is 48/0.5 = 96; while A (= α/r^2) will be $0.24/(0.5/12)^2 = 14$ approx. The continuous running time before this spacing should affect the operation would be about $1000 \times 14 = 75$ hr. This raises the question as to whether 75 hr would simulate the effective previous intermittent operation, and is one factor which still needs further study. At least about 140 hr would be needed to appreciably reduce the effectiveness of the tube. With this spacing the mutual effects should be rather negligible.

With a 4-ft spacing, assuming 100-ft runs, the number of parallel tubes required would be approximately 14 or a plot 56 ft wide, and thus 5600 sq ft of soil are required. A more careful design should be used to determine whether it need be somewhat larger or could be somewhat smaller, as well as determination of the desirable spacing and depths.

Conclusions

There seems little question but that the intermittent type of tests gives more dependable information for use in practical design of ground grids than that obtained from single continuous runs. A greater number of tests, each with a considerable amount of details of design factors, measured temperatures, etc., would be most desirable. More comparison tests between line and grid sources as well as tests to determine the nature and effects of film coefficients, would provide valuable and much needed data.

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4. Factors Useful in Ground Grid Design for Heat Pumps, by G. S. Smith (ASHVE TRANSACTIONS, Vol. 57, 1951, p. 1991).

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7. Residential Heat Pump Experiments in Philadelphia, Earth as a Heat Source, by A. H. Kidder and J. H. Nelter, (*AIEE Transactions*, Part II, Applications and Industry, Vol. 71, 1952, pp. 343-350).

8. Residential Heat Pump Experiments in Philadelphia, Installation and Operating Experience, by J. H. Harlow and G. E. Klapper (*AIEE Transactions*, Part II, Application and Industry, Vol. 71, 1952, pp. 366-375).

9. Climatology as an Aid in Heat Pump Design, by G. S. Smith (ASHVE TRANSACTIONS, Vol. 57, 1951, p. 1991).

10. Soil Temperatures, Moisture Content, and Thermal Properties, by C. L. Carter (*Engineering Experiment Station Bulletin No. 15*, University of Tennessee, Knoxville).

11. Thermal Conductivity of Soils for Design of Heat Pump Installations, by G. S. Smith and Thomas Yamauchi (ASHVE TRANSACTIONS, Vol. 56, 1950, p. 355).

12. Thermal Properties of Soils, by Miles S. Kersten (University of Minnesota, *Engineering Experiment Station Bulletin No. 28*).

13. Sizing Earth Heat Pumps, by E. B. Penrod (*Refrigerating Engineering*, Vol. 62, April 1954, p. 57).

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Hon. Herbert Hoover

Dr. Charles F. Kettering

Dr. Milton S. Eisenhower

Brig. Gen. Thomas A. Lane

ASHAE Welcomes Hoover, Kettering, Eisenhower As Honorary Members

At Semi-Annual Meeting, Washington, D.C.

Three new Honorary Members of the Society, Hon. Herbert Clark Hoover, distinguished engineer and former president of the United States, Dr. Milton S. Eisenhower, scientist and educator, and Dr. Charles F. Kettering, researcher, inventor and industrialist, have been invited to the Semi-Annual Banquet, June 20, to receive Honorary Membership Certificates presented by Pres. John W. James.

The Semi-Annual Meeting 1956 will begin on Monday, June 18, in The Shoreham and consist of 7 sessions comprised of 14 papers and 2 symposia. It will be concluded on Wednesday evening with the Semi-Annual Banquet.

The Honorable Arthur S. Flemming, director, Office of Defense Mobilization, will deliver the banquet address. President of Ohio Wesleyan University, this distinguished educator and statesman has been on leave of absence while assisting the federal government in this and other capacities.

Brig. Gen. Thomas A. Lane, engineer commissioner, District of Columbia, will deliver the main address at the Welcome Luncheon on Monday. He will be introduced by Brig. Gen. Wilmot A. Danielson, who served on the Council of the Society from 1944 to 1947 and was the first president of the Washington, D. C. Chapter.

Hon. Arthur S. Flemming

General Lane is a graduate of the United States Military Academy, Massachusetts Institute of Technology and several specialized military schools, including the National War College. During World War II he served as operations officer on the theatre engineer staff, General Headquarters, Southwest Pacific Area in the campaigns from New Guinea to the Philippines.

Following the luncheon many members are expected to participate in or witness the ASHAE annual golf tournament at the Congressional Country Club. Contestants will compete for the Past Presidents Research Bowl, Eichberg Memorial Cup and Paul Bunyan Trophy. Non-golfers will have an opportunity to inspect the David Taylor Model Basin, and the ladies and children can look forward to visiting the Pakistan Embassy and Islamic Center.

There will be no sessions on Monday afternoon. However, at 2:15 p.m. a number of technical advisory committee meetings will take place. Monday evening at 7:30 p.m. almost everyone is expected to meet on the Shoreham Terrace for a Get-Together Party.

The Semi-Annual Meeting will be in full progress on Tuesday with two simultaneous sessions scheduled for the morning and various committee meetings arranged for the afternoon and evening.

On Wednesday, the concluding day of the meeting, the morning will be taken up with two concurrent sessions: one offering papers on solar energy, heat pumps and intermittent heating and cooling, the other session being a standards and codes symposium. The afternoon sessions will also run simultaneously. One will consist of two papers, report of the Resolutions Committee, unfinished and new business and adjournment. The other will be a symposium on residential air conditioning.

Program for ASHAE Semi-Annual Meeting, June 18-20, 1956

The Shoreham — **Washington, D.C.** — **The Sheraton-Park Hotel**

All meetings and events at The Shoreham unless otherwise designated

Saturday — June 16

1:30 p.m. Regions Central Committee

Sunday — June 17

9:30 a.m. Council Meeting

10:00 a.m. Research Executive Committee, B. H. Jennings, *Chairman*

2:00 p.m. Committee on Research

8:00 p.m. Reception and Movie

Monday — June 18

9:00 a.m. REGISTRATION (*Main Lobby*)

9:30 a.m. FIRST SESSION (*West Ballroom*)
Call to Order — Pres. John W. James

Greetings by P. R. Achenbach, Chairman, Committee on Arrangements
Comparative Performance of Indirect Water Heaters, by L. L. Hill and W. S. Harris
Natural Convection and Radiation in a Panel Heated Room, by T. C. Min, L. F. Schutrum, G. V. Parmelee and John Vouris

9:30 a.m. Ladies' Sightseeing Trip to Federal Bureau of Investigation

12:00 p.m. WELCOME LUNCHEON (*Blue Room*)
Toastmaster: Gen. W. A. Danielson
Speaker: Brig. Gen. Thomas A. Lane, Engineer Commissioner, District of Columbia

1:00 p.m. Golf Tournament (*Congressional Country Club*)

1:00 p.m. Inspection Trip — David Taylor Model Basin

2:15 p.m. TAC on the Heat Pump, F. R. Ellenberger, *Chairman*

2:30 p.m. Ladies' Sightseeing Trip to Pakistan Embassy and Islamic Center

7:30 p.m. Get-Together Party (*Shoreham Terrace*)

Tuesday — June 19

9:00 a.m. REGISTRATION (*Main Lobby*)

9:30 a.m. SECOND SESSION (*Main Ballroom*)
Call to Order — Vice Pres. P. B. Gordon

Vice Chairman, L. G. Miller

Heat Requirements of Snow Melting Systems, by W. P. Chapman and Samuel Katunich
Small-Pipe Perimeter Heating in a Residence, by D. R. Bahnfleth, H. T. Gilkey and C. F. Chen
Heat Load Calculations by Thermal Response, by W. R. Brisken and S. G. Reque

9:30 a.m. THIRD SESSION (*West Ballroom*)
Call to Order — Vice Pres. E. R. Queer

Vice Chairman, R. S. Dill

Air Velocities in Two Parallel Ventilating Jets, by Alfred Koestel and J. B. Austin, Jr.
Dependence of Water Vapor Permeability on Temperature and Humidity, by S. C. Chang and N. B. Hutcheon
Effect of Unbalanced Air Pressure on Permeance, by F. A. Joy and D. R. Fairbanks

9:30 a.m. Ladies' Visit to White House and Capitol

12:00 noon Inspection Trips (Buses leave between 12:00 and 12:30 p.m. Cafeteria service available on arrival):
(*a*) Naval Ordnance Laboratory
(*b*) National Institute of Health

1:00 p.m. Sightseeing Trip to Mt. Vernon (*Boat and Bus*)

1:30 p.m. Guide Committee, Albert Giannini, *Chairman*

2:00 p.m. Nominating Committee, I. Donald Knocker, *Chairman*

7:45 p.m. Technical Advisory Committee Meetings

8:00 p.m. Chapter Publicity Chairmen and Publication Editors

Wednesday — June 20

9:00 a.m. REGISTRATION (*Main Lobby*)

9:30 a.m. FOURTH SESSION (*West Ballroom*)
Call to Order — Pres. John W. James

Vice Chairman, W. F. Friend

Laboratory for Solar Energy Study at Minnesota, by R. C. Jordan and J. L. Threlkeld
Intermittent Ground Coils for Heat Pumps, by G. S. Smith
Intermittent Heating and Cooling of Buildings, by P. L. Flemingwerth and Merl Baker

9:30 a.m. FIFTH SESSION (*Main Ballroom*)
Call to Order — Vice Pres. P. B. Gordon

Vice Chairman, T. H. Urdahl

STANDARDS AND CODES SYMPOSIUM
C. H. Pesterfield, Moderator
Standards and Codes in General — J. C. Batts
Protective Standards — Cyril Ainsworth
Governmental Aspects — R. S. Dill
Local and Municipal Standards and Codes — John W. James
Commercial-Industrial Standards — G. S. Jones
Establishment of Standards and Codes through Experimentation — L. N. Hunter

12:30 p.m. Ladies' Luncheon and Fashion Show (*Sheraton-Park Hotel*)

2:00 p.m. SIXTH SESSION (*Main Ballroom*)
Call to Order — Vice Pres. E. R. Queer

Vice Chairman, W. A. Grant

SYMPOSIUM ON RESIDENTIAL AIR CONDITIONING
L. H. Haeger, Moderator
New Concepts of Comfort Cooling — W. H. Scott
Combination Fuel Operated Systems — W. E. Hood
Fuel Operated All-Year Systems — A. B. Newton
Electrically Operated Systems — E. R. Ambrose
Future System Developments — W. F. Friend

2:00 p.m. SEVENTH SESSION (*West Ballroom*)
Call to Order — Pres. John W. James

Vice Chairman, P. B. Gordon

Performance of One-Row Tube Coils With Thin Plate Fins, Low Velocity Forced Convection, by D. G. Shepherd
Temperature and Humidity Effect on Odor Perception, by W. F. Kerka and C. M. Humphreys
The Indirect Evaporative Air Cooler, by J. R. Watt and R. A. Bacon
Report of Resolutions Committee
Unfinished Business
New Business
Adjournment

6:30 p.m. Social Hour (*West Ballroom*)

7:00 p.m. SEMI-ANNUAL BANQUET (*Terrace Banquet Room*)
Speaker: Hon. Arthur S. Flemming, Director, Office of Defense Mobilization
Presentation of Honorary Membership Certificates, Past Presidents Memory Book and Golf Trophies

Region 3 Chapters Regional Committee Meets in Omaha

(l. to r.) John E. Haines, Regional Director; P. B. Gordon, Society 1st Vice President; R. S. Stover, Secretary, Chapters Regional Meeting

(l. to r.) J. S. Locke and E. T. Erickson, Minneapolis; E. R. Queer, Society 2nd Vice President; W. P. Norris, St. Louis; R. M. Spencer, Kansas City

Regional Director John E. Haines, Minneapolis, called the meeting to order at 9:15 a.m. in the West Room of the Fontenelle Hotel, Omaha, Neb., on Tuesday, May 8. A. V. Hutchinson called the roll.

The committee members and alternates present were:

Iowa: R. S. Stover, Marshalltown; G. J. Kraai, Des Moines. Kansas: H. M. Skalla, Wichita. Kansas City: R. M. Spencer, S. C. McCann, Kansas City, Nebraska: L. J. Paulsen, C. A. Failor, Omaha. Minnesota: J. S. Locke, E. T. Erickson, Minneapolis. Rocky Mountain: L. L. DeLong, Denver, Colo. St. Louis: W. P. Norris, St. Louis.

T. E. Davis, president of the Nebraska Chapter, welcomed the committee, the Society officers, and other visiting members.

Chairman Haines called for nominations for the committee secretary and R. S. Stover, Marshalltown, was unanimously elected.

P. B. Gordon, first vice president of the Society, was introduced and spoke on the Philosophy of the Regional Plan for the Operation of Chapters. With the aid of slides Mr. Gordon explained the workings of the regional plan and cited its basic purposes to: 1) advance knowledge; 2) encourage research; 3) promote knowledge of heating, ventilating and air conditioning; 4) establish high standards; 5) cooperate with government agencies, schools, etc.; 6) assist in the formation of local chapters.

He described the major mechanisms used to carry out these purposes by means of meetings, talks, papers, publications and basic research.

Mr. Gordon outlined the development of the regional plan from 1947 to 1955 and gave the highlights of the By-Law revisions approved in January 1956. He explained the operation of the seven chapters regional committees, the functions of the regions central committee and the duties of the seven regional directors and the nominating committee changes.

Mr. Gordon described the operation of the chapters agenda and the processing of suggestions and recommendations proposed by the chapters regional committees.

Mr. Gordon expressed Pres. John W. James' regrets that he was unable to be present because of business committments in Europe at this time and spoke briefly about the problems of Society growth and the need for advance planning to meet the needs of the expanding economy.

There was an interesting discussion period about the regional plan.

Chairman Haines then invited the members to present questions for the chapters' agenda which are to be transmitted to the Regions Central Committee.

A luncheon was served in Parlor A and 40 were present. Prof. E. R. Queer, second vice president of the Society, spoke in an entertaining manner on the subject of Engineers and Their Relationship to People.

Following the luncheon recess, the committee was called to order for its second session at 2 p.m.

Chairman Haines said that its first duty was to elect a member and two alternate members to serve on the 1957 nominating committee. The following were nominated and elected: Member: J. S. Locke, Minneapolis; First Alternate: Fred Jannsen, Denver; Second Alternate: D. M. Allen, Kansas City, Mo.

Following an executive session Chairman Haines said that chapter problems would be discussed and a discussion leader had been selected for each subject. L. J. Paulsen spoke on Membership; W. F. Norris, Programs; J. S. Locke, Attendance; R. S. Stover, Publicity; R. M. Spencer, Publications; L. L. DeLong, Dues; H. M. Skalla, Chapter Business.

Some very worthwhile suggestions were offered in the discussion of each subject.

Chairman Haines asked for suggestions for the time and place of the 1957 committee meeting and invitations were offered by the Minnesota Chapter, Kansas City Chapter and Rocky Mountain Chapter.

The meeting adjourned at 5:30.

The President's Page

Notes from Abroad

THESE IMPRESSIONS are written from London on a business trip when about one-half of the projected visits have been accomplished.

Exceedingly pleasant was the very cordial reception at the fine headquarters' home of the Institution of Heating and Ventilating Engineers located here where B. A. Hodges, newly appointed Secretary of the Institution extended greetings.

The permanent headquarters of the Institution is situated in a quiet square overlooking private gardens, and is arranged with an adequate suite of rooms for office procedure, includes also a dignified Council Chamber and Members' Room and a Library with a most impressive collection of books and references.

It was also a great pleasure to be entertained at dinner by the President of the Institution, J. C. Byles, and Senior Vice Pres. W. R. Cox, along with Mr. Hodges, after being met upon arrival by the immediate Past Pres. Vernon Hardy.

As a further most welcome courtesy the Institution presented as a gift a copy of the brand new edition of its Guide to Current Practice which contains 424 pages of valuable technical data, an index to the Proceedings and Journal of the Institution, as well as 117 pages of manufacturers' catalog data.

Attendance at the Institute of Fuel Conference on May 1 and 2, offered the opportunity of extending greetings from our Society to the Conference. The visit also permitted observing the active progress being made by the heating fraternity here in cooperating with the new Clean Air Act already partially enforced and designed to eliminate faulty combustion of fuels. From the papers and remarks presented, it is also evident that fuel oil is to have increasing acceptance with automatic control of central heating systems used in an expanding market.

It has also been possible to visit several outstanding installations of equipment with the London airport buildings perhaps most noteworthy in this brief report. High temperature water at 350 F and 200 psi pressure is generated at a central boiler house and distributed to variously located water-to-water and water-to-steam heat exchangers. Lower temperature water is then circulated by automatic control through ceiling and floor panels and convectors, the latter used primarily in areas of large heat loss. Special attention has been given to ventilation in all of the large occupancy spaces. One of the newer terminal buildings now under construction is being provided with an air cooling arrangement.

This morning it was a delight to have a visit with our ASHAE member, R. L. Blanding, who has completed an extended world tour including a safari through Africa.

John W. James

President
American Society of Heating and Air-Conditioning Engineers

Journal Section

SHERMAN AT COAL RESEARCH MEETING

ASHAE Treas. R. A. Sherman reports that Bituminous Coal Research, Inc., held its annual meeting along with its third Techno-Sales Conference at Columbus, on April 18 and 19. All phases of the research program were reviewed, increased use of coal in the aluminum industry was predicted. General theme of the program was *The Place of the Fuel Engineer in the Coal Industry.*

SHEET METAL CONTRACTORS ELECT KUECHENBERG

At its Annual Convention held in Washington, May 9-12, the *Sheet Metal Contractors National Association* elected W. A. Kuechenberg as its president.

Mr. Kuechenberg, who has been a member of ASHAE since 1937 and past president of the Illinois Chapter, is also president of R. B. Hayward Co., Chicago.

URDAHL MOVES OFFICE

It has been announced that the offices of Thomas H. Urdahl have been located in The Machinists Building, 1300 Connecticut Ave., N. W., Washington, D. C., since May 1, 1956. Mr. Urdahl is currently on the Society's Technical Advisory Committees on Human Calorimetry and Odors.

COLBERT HEADS TEXAS A. & M. ARCHITECTURE

It has been announced that C. R. Colbert, an architect and planner, recently practicing in New Orleans, will become professor of architecture and Head of Division of Architecture at the Texas A. & M. College effective September 1, 1956.

ASHAE HEAVY DUTY FURNACE CODE

The ASHAE Code for Testing and Rating Heavy Duty Furnaces and Direct Fired Unit Heaters is now available from Society headquarters in printed form.

The code provides a method for testing and rating heaters having output capacities in excess of 250,000 Btu per hr and is intended for use when testing heaters for which there now are no applicable requirements.

Included in the code are definitions of terms pertaining to the heaters; specifications for rating limits; testing equipment, methods and procedure; rating procedure; and a form for recording test readings and making computations.

The committee which prepared the code consists of the following: E. K. Campbell, chairman; Bowen Campbell, R. S. Dill, A. P. Loeb, C. J. Low, W. J. MacGirl, B. F. McLouth, F. L. Meyer, L. G. Miller, A. A. Olson, H. A. Pietsch, O. J. Ress, H. A. Soper.

JAMES PRESENTED TO QUEEN ELIZABETH

At his visit to the British Industries Fair in London on April 26, Pres. John W. James had the honor of being among those presented to Her Majesty The Queen and H.R.H. The Duke of Edinburgh. President James and S. H. Rich, export manager, McDonnell & Miller, Inc., Chicago, and member of ASHAE, are touring several Western European countries, including France, Belgium, and Holland, besides England

Summary of Chapter Meetings*

• *ARIZONA*: Residential load research in the Phoenix metropolitan area during the summer of 1955 was the subject of a discussion given at the March meeting by Clint Yates, Arizona Public Service Co., Arizona. Mr. Yates, who was introduced by F. W. Gabbard, gave members information on the rates charged for operating a refrigeration unit in the home. The meeting was presided over by Pres. W. V. Biddle. Attendance 37.

• *ATLANTA*: ASHAE Pres., John W. James, Chicago, Ill., spoke on *Humanity Benefits from Air Conditioning* at the March meeting, presided over by Pres. T. A. Burrow. Attendance 74.

• *BATON ROUGE*: A standing ovation was given at the March meeting to W. G. Wassmandorf, The Trane Co., La Crosse, Wis., for his film and talk on *Refrigeration Piping*. During his talk, Mr. Wassmandorf explained the installation of refrigeration piping, and he also answered questions after the meeting was concluded. The speaker was introduced by W. J. LeBlanc, and the president, C. S. Woodruff, presided.

Prior to the talk, three members, F. D. Beaullieu, III, J. P. Jones, and A. E. Kaiser, were elected to the nominating committee for the coming elections. Attendance 33. Attendance ratio 0.46.

• *BLUEGRASS*: In the absence of Pres. W. M. Pace, who was attending a Chapter's Regional Committee meeting at Atlanta, Ga., the March meeting was presided over by Vice Pres. W. J. Killian.

Following a report on the Bluegrass Chapter committee on the ventilation code, members heard Robert Diehl, president, Diehl Pump and Supply Co., give a talk on the evolution of the use of water in air conditioning. The speaker, who was introduced by J. B. Uhl, pointed out the importance of water in our everyday lives and its very low cost to us. Mr. Diehl explained the necessity of the forced and/or induced draft cooling tower and gave examples of various models.

• *BRITISH COLUMBIA*: A diamond lapel pin was given to S. C. Gale, immediate past president, by C. W. Leek at the March meeting. Pres. Cornelius Van Boyen was in the chair. Guests at the meeting included 28 students, and Prof. F. W.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Vernon, University of British Columbia, who gave brief sketches concerning chapter members graduated from his classes.

Sound Control in Ventilating Systems was the talk given after the business meeting, by Daniel Callaway, acoustical engineer, Koppers Corp., who was introduced by R. B. McDonnell. Mr. Callaway explained by means of slides the various charts compiled by engineers delving into the mysteries of sound and outlined the analyzing process for mechanical vibration, air turbulence and duct rumble. Attendance 77. Attendance ratio, 0.56.

• *CENTRAL NEW YORK*: John Everetts, Jr., Philadelphia, Pa., regional director, Region No. 1, explained the working of the new regional plan to members attending the March meeting, presided over by Pres. L. A. Childs.

A clear and factual talk was given by Sheldon Pitkin, sales engineer, Machinery and Systems Division, Carrier Corp., Syracuse, N.Y., on *Air Conditioning of Existing Office Buildings*. An indication of members' interest in the subject was manifested by the lively discussion during the question period after the speech. The speaker was introduced by S. F. Gilman. Attendance 59. Attendance ratio 0.27.

• *CENTRAL OHIO*: *The Fundamentals of Refrigeration* was the subject of a sound slide discussion presented by R. C. Liebert, president, Capitol Refrigeration Co., Columbus, Ohio, at the March meeting of the chapter. The program was a particular success because Mr. Liebert took over on short notice due to the absence of the scheduled speaker, grounded by a storm in the East. A panel, consisting of R. S. Curl, W. A. Schoonover and Mr. Liebert, led a discussion following the talk.

The meeting was presided over by Vice President Schoonover in the absence of Pres. R. A. Wilson. Attendance 36. Attendance ratio 0.25.

• *CONNECTICUT*: A letter received from the state commissioner of education, requesting chapter cooperation in a program to improve science education and to encourage students to enter the engineering and scientific field, prompted the election at the March meeting of a committee, consisting of J. D. Pierce and L. R. Phillips, to study this problem. An auditing committee was also appointed, with R. M. Johnson, R. B. Calhoon and W. J. Waechter as members.

After business was concluded, a panel discussed *Heating and Ventilating of School Classrooms*. The moderator of the panel was Austin Mather, Lyon & Mather, Architects, and speakers were: R. P. Campbell, secretary, E. K. Campbell Co., Kansas City, Mo.; C. S. Stock, manager, Herman Nelson Unit Ventilator Sales, American Air Filter Co., Inc., Louisville, Ky.; and J. W. Pierce, chief engineer, The Vulcan Radiator Co., West Hartford, Conn. Attendance 157. Attendance ratio 0.35.

• *DELTA CHAPTER*: A joint ASHAE-*ASRE* meeting was held in March under the chairmanship of Pres. W. B. Martin and *ASRE* Section Pres. E. K. Strahan, Sr., respectively.

The evening's speaker was W. G. Wassmansdorf, The Trane Co., La Crosse, Wis., who spoke on *Problems in the Design and Operation of Refrigeration Systems*. Members found Mr. Wassmansdorf's talk both interesting and informative, and he was given a 'rising' vote of thanks at the end of the question period. The speaker was introduced by the chairman for the latter part of the meeting, E. H. Sanford, chairman of the technical papers committee for the chapter. Attendance 71.

• *EMPIRE STATE*: Members at the March meeting heard an interesting and informative discussion by C. H. Burkhardt, general manager, Paragon Maintenance Co., Mineola, N.Y., on the sale and problems of residential air conditioning. Mr. Burkhardt also outlined the potential and past performance of air conditioning. Pres. E. V. Appleby was in the chair. Attendance 25. Attendance ratio 0.38.

• *ILLINOIS*: The following seven members were announced at the March meeting as elected to the nominating committee for the coming year: H. E. Anderson, M. J. Raimond, C. C. Freyder, H. C. Gragg, E. P. Heckel, Jr., Herbert Kreisman and L. O. Paul. Chairman for the business meeting was Pres. C. C. Freyder.

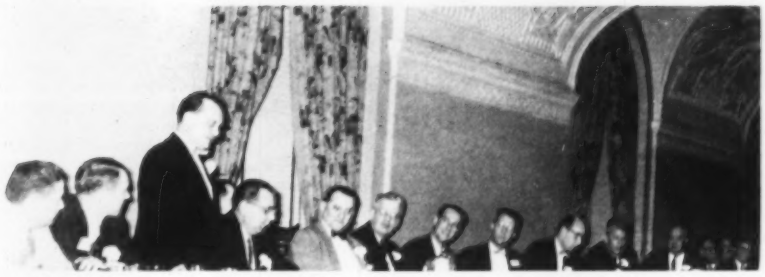
The chapter's meeting chairman, C. H. Johnson, Jr., then introduced the speaker, G. C. Savage, consulting engineer, Bevington, Taggert and Fowler, Indianapolis, Ind. Mr. Savage spoke on *High Velocity Air Distribution — Design and Problems*. He discussed the selection of equipment in great detail and gave members the benefit of his experience in high-velocity jobs by recommending the specific types of fans, dampers and ductwork which he had found superior in overcoming high-velocity problems. An extensive question period followed Mr. Savage's speech. Attendance 168.

Cincinnati Chapter Honors Its Past Presidents

Framed certificates acknowledging their services were presented to the Cincinnati Chapter past presidents at the first past presidents' dinner of the Chapter, held on April 2, at the Alms Hotel with Pres. A. H. Gerdsen presiding.

R. G. Anderson, acting as meeting chairman, presented the certificates to the following past presidents: G. B. Houliston, I. B. Helburn, O. W. Motz, R. E. Kramig, W. H. Junker, G. V. Sutlin, E. J. Richard, A. W. Edwards, M. E. Mathewson, K. B. Little, E. W. McNamee, J. J. Bechtol, H. E. Russell, R. C. Beineke, W. W. Wilson. Also among the honored past presidents, although not in attendance, are: K. A. Wright, H. E. Sproull, Albert Buenger, and H. K. Jennings.

Through the efforts of J. A. Lamb, meeting chairman, an interesting meeting was arranged with F. W. Giesel, business manager of the *Cincinnati Post* as the guest speaker. Mr. Giesel held the attention of his audience as he addressed the gathering on the subject of *Tomorrow*. Attendance 70. Attendance ratio 0.53.



Journal Section

• *INDIANA*: A joint ASHAE-*ASRE* meeting was held in March under the chairmanship of J. W. Jackson, president of the ASHAE chapter. Members took part in a question and answer session lasting one hour and a half, after listening to a panel discussion on air conditioning and refrigeration.

• *INLAND EMPIRE*: Slides were used to illustrate a detailed and interesting talk, on the design and applications of high pressure air distribution and diffusion, by P. A. Argentieri, engineering administrator, Connor Engineering Corp., Danbury, Conn. He spoke at the March meeting of the chapter, presided over by Pres. E. W. Jenkinson, and was introduced by K. A. Hettinger.

Announced as elected to the nominating committee for this year were: W. N. Pauley, *chairman*; W. F. Kelly, F. J. Lund and L. E. Marque. Attendance 38. Attendance ratio 0.47.

• *IOWA*: *Water and Its Effect on Mechanical Equipment in Buildings* was discussed by V. M. Roach, chief engineer, General Filter Co., Ames, Iowa, at the March meeting presided over by Pres. G. J. Kraai.

Mr. Roach, who was introduced by Program Chairman D. E. Schroeder, presented methods of treatment for corrosion, sludges and scales resulting from the use of mineral waters and also outlined water problems in water-cooled condensers. He indicated that even for once-through systems, iron removal is the most essential treatment for Iowa waters. Attendance 43. Attendance ratio 0.37.

• *KANSAS CITY*: An extremely well-prepared and well-delivered talk on *Vibration and Noise Control for Air Conditioning Equipment* was presented at the March meeting by D. H. Vance, vice president and executive engineer, The Korfund Co., Inc., Long Island City, N. Y. The speaker was introduced by R. M. Spencer, program chairman, and the meeting was presided over by Pres. A. S. Hurt, Jr.

Prior to the talk, a nominating committee was elected, consisting of D. M. Allen, E. K. Campbell, P. C. Lefell and W. A. Reichow. Attendance 72.

• *MANITOBA*: The necessity of selling good heating to the women of America in order to improve the quality of installation was expressed by C. W. Nessell, industry consultant, Minneapolis-Honeywell Regulator Co., Chicago, Ill., in an inspiring talk at the March meeting. Introduced by J. F. Bertram, Mr. Nessell spoke on the *Advancement of Warm Air Heating during the Past Ten Years*. W. J. Atkinson expressed the chapter's appreciation for this presentation.

Secy. A. H. Millar read a letter of invitation from D. L. Angus, president of the Ontario Chapter, inviting Secretary Millar and G. C. Davis, member and alternate of the Chapters Regional Committee for Region 7, to be dinner guests at the Regional Meeting. Attendance 26. Attendance ratio 0.49.

• *MASSACHUSETTS*: John Everetts, Jr. Philadelphia, Pa., spoke to chapter members at the March meeting on the operation of the Society under the Regional Plan and the advantages expected to be obtained. He was introduced at the meeting by the presiding chairman, Pres. G. D. Fife.

A brief history of the Texas Tower radar installation was given by M. G. Rolland, Anderson Nichols Co., Boston, Mass., prior to a showing of a film on the construction and installation of the tower.

• *MEMPHIS*: Pres. John Hilton, II, presided over the March meeting of the chapter, attended by C. B. Gamble, ASHAE regional director for Region 5, as one of the guests.

A film on *Highlights of Georgia Tech Games* was presented by G. S. Flinn, owner, Flinn Engineering Co., Memphis, Tenn. Mr. Flinn was introduced by Program Chairman W. L. Henson. Attendance 31.

NOTICE OF SEMI-ANNUAL MEETING 1956

Please take notice that the Semi-Annual Meeting 1956 of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS will take place in Washington, D. C. at The Shoreham at 9:30 a.m. on Monday, June 18, 1956 and will continue through the 19th and 20th. An advance copy of the program was mailed to members of the Society and they have been informed in greater detail through the ASHAE JOURNAL SECTION of *Heating, Piping & Air Conditioning*.

There are 14 technical papers and two symposia on Standards and Codes and Residential Air Conditioning.

Three new Honorary Members, Hon. Herbert Clark Hoover, distinguished engineer and ex-president of the United States, Dr. Milton S. Eisenhower, scientist and educator, and Dr. Charles F. Kettering, researcher, inventor, and industrialist, have been invited to the Semi-Annual Banquet, June 20, to receive their Honorary Membership Certificates to be presented by Pres. John W. James.

JOHN W. JAMES
PRESIDENT
May 10, 1956

A. V. HUTCHINSON
EXECUTIVE SECRETARY

Method of Choosing Location of, Financing and Conducting Meetings of the Society

Resolved: That inasmuch as the Annual and Semi-Annual Meetings of the Society come under the jurisdiction of the Council, the following rules governing the handling of such meetings be adopted by the Council and published in the JOURNAL of the Society at least twice during every year, preferably just prior to each meeting.

1—The Council will select the city in which the Annual or Semi-Annual Meeting is to be held, giving due consideration to the invitations received from Chapters or members as well as to the advisability of so distributing those meetings as to make them of the greatest advantage to the general membership, and to reduce as far as possible the expense of members attending.

2—That an appropriation be made to cover the entertainment or local expenses, incurred in connection with the meeting, and the regular meeting expenses to be taken care of by the General Fund of the Society in the regular way.

3—That no registration fee or compulsory obligations of any nature be imposed on members or guests.

4—That the purchase of tickets for banquets or for any other form of entertainment that may be provided be entirely voluntary.

5—That the grouping of features and the sale of tickets for group features be discouraged.

6—That the raising of funds from manufacturers of heating apparatus be discouraged.

7—That the display of samples, or of literature, advertising the product of any manufacturer in any way, shape or form, be not permitted at the booths, registration desk, or in or about the meetings.

8—That the distribution of trade papers be entirely at the discretion of the committee in charge.

9—That the local Chapter or local members be empowered to form a General Committee with such sub-committees as may be required to handle the details of transportation, hotel accommodations, entertainment, finance, etc., and that this General Committee be requested to confer frequently with the Council, through the Executive Secretary of the Society, and to make frequent reports on progress in connection with the various matters being handled by them.

10—That the arrangements of elaborate and costly entertainment features be discouraged.

Adopted at Council Meeting, January 29, 1926.

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• *MIAMI VALLEY*: After reports from the special events committee, auditing committee and nominating committee, and the conclusion of the business meeting, members heard a talk on *Application of Room Type Heating-Cooling Units* by Herb Clark, Modine Manufacturing Co., Racine Wis. Mr. Clark was introduced by J. B. Rishel, and the meeting was presided over by Pres. D. E. Tullis.

• *MICHIGAN*: After the introduction by Pres. D. S. Falk of officers and guests, members at the March meeting heard J. C. Barrett speak on *Industrial Ventilation*. Bernard Bloomfield and Marvin Schumann, Michigan Department of Health, were also presented to the audience. Attendance 78. Attendance ratio 0.23.

• *MINNESOTA*: John W. James, Chicago, Ill., ASHAE president, attended the March meeting of the chapter and made an interesting speech on *Air Conditioning and its Psychological Effects on Human Beings*. Mr. James was introduced by the Society's immediate past president, John E. Haines. Minnesota Chapter Pres. J. S. Locke was in the chair. Attendance 111.

• *MISSISSIPPI*: At the March meeting, Pres. B. L. Palmer reported on his trip to the Regional Meeting held in Atlanta, Ga. He also told the members of the election of C. M. Broad as chairman of the committee scheduled to work with Mississippi State College on their proposed Heating and Air Conditioning School.

After all business had been conducted, the program chairman, T. N. Dent, introduced the speaker of the evening, John Mawion, who gave a talk on *Marketing of Air Conditioning*. Attendance 34.

• *MONTREAL*: *Snow Melting Systems* was the subject of a discussion by a panel at the March meeting of the chapter. The panel moderator was J. P. Wolofsky and his speakers were Guy Morel, Harold Tamm and R. W. Smith, all of Montreal. The practical and theoretical problems of designing a snow melting system were mentioned by Mr. Morel, and after a question period, Mr. Tamm summed up the conclusions of the panel. The presiding officer for the meeting was Pres. R. J. Ker. Attendance 68. Attendance ratio 0.22.

• *NORTH JERSEY*: A large and attentive audience of members and their guests, including section officers of *ASRE*, were present at the March meeting of the chapter, presided over by Pres. C. H. Smith.

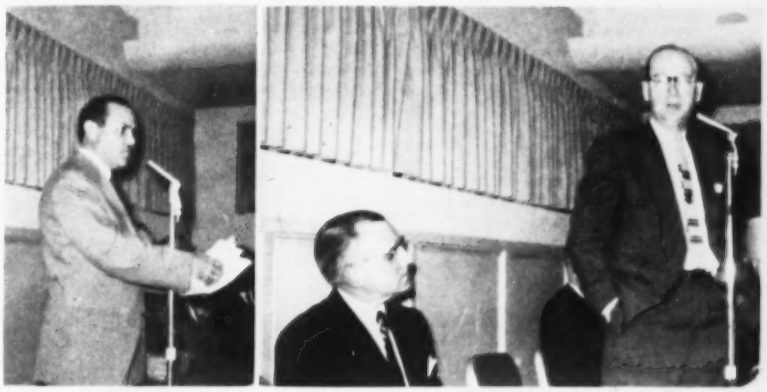
Discussions of great interest to the meeting were given by W. S. Harris, professor, mechanical engineering, University of Illinois, Urbana, Ill., and R. E. Ferry, general manager, *Institute of Boiler and Radiator Manufacturers*, New York, N. Y. Mr. Ferry spoke on the history and purposes of the Institute, and Professor Harris told members of the results of tests made on baseboard heating, and the effects and cost of various cooling systems which had been under study for the last three years. He illustrated his talk with slides. Attendance 164. Attendance ratio 0.43.

• *NORTH TEXAS*: Society Pres. John W. James, Chicago, Ill., was present at the March meeting of the chapter, together with First Vice Pres. P. B. Gordon, New York, N.Y.; Second Vice Pres. E. R. Queer, University Park, Ill.; and Executive Secy. A. V. Hutchinson, New York, N.Y. Also present was D. M. Mills, Houston, Tex., regional director for Region 6. H. G. Gregerson, President of the North Texas Chapter, was in the chair.

After registration figures for the Regional Meeting held earlier in the day had been announced, President Gregerson expressed thanks on behalf of the chapter to members who had made the arrangements for the regional meeting. A round of applause was given to the president, in turn, for his own efforts on behalf of the meeting.

The chief speaker of the evening was President James, who traced the background, development and potentials of the Society. President James, who was introduced by George Linskie, mentioned that the Society is keeping abreast of heating developments from nuclear energy through the appointment of a nuclear energy committee. He also touched upon the studies made in air purification and cited the importance of air conditioning in the medical field. The president emphasized the need for young, energetic and visionary men in the industry and told members of steps which are being taken to induce a growth in engineering training. He concluded with a tribute to the Society for bringing together all men having a common interest in its field. Attendance 132.

• *NORTHEASTERN OKLAHOMA*: A discussion on the design of laboratories to foster plant life was given at the March meeting by A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif. Mr. Hess, who was introduced by W. R. Lee, said that the search for new sources of energy is being investigated from the standpoint of utilizing energy of the sun to make efficient plant life which can be converted into alcohol and fuels. Pres. H. W. Meinheltz was in the chair. Attendance 31.



G. A. Linskie (left) introducing Society Pres. John W. James, Chicago, guest speaker at the March meeting of the North Texas Chapter. H. G. Gregerson (right), North Texas Chapter president, calling the meeting to order, with President James seated at the left

• *NORTHERN ALBERTA*: Conveying his personal congratulations and those of the Ontario Chapter, W. J. Coates, sales manager, Sarco Canada, Ltd., Toronto, addressed the March meeting. Mr. Coates, who was introduced by J. L. Higgs, then proceeded with his main topic, *Steam Trapping and Air Venting*, covering cataloging, selection, and application of various types of traps. With the assistance of projected slides, Mr. Coates illustrated the principle of operation and limitations of each type. Examples of misapplication were demonstrated, together with suggested steps to eliminate problems encountered in trap installations.

Pres. W. C. Woods reviewed the purpose of the Regional Meeting held in Toronto in April. He advised that at an executive meeting appointments were made for the Chapters Regional Committee for Region 7, with P. M. Butler as member and E. K. Cumming as alternate.

In closing, President Woods pointed out to those in attendance that Mr. Coates and M. C. Bailey of Toronto had provided valuable assistance in organizing the Northern Alberta Chapter and moved a vote of thanks to these gentlemen. Attendance 33.

• *NORTHERN OHIO*: Interesting data on *Residential Air Conditioning* were given by the speaker at the March meeting, Mr. Munger, Owens-Corning Fiberglas Corp., Toledo, Ohio.

At this meeting, at which Pres. L. C. Burkes presided, John Richmond, J. M. Black and R. E. Sherman were elected to serve as a nominating committee. Vice Pres. H. R. Canoyer, member, Chapters Regional Committee for Region 2, reported briefly on the Regional Plan of Operation. Attendance 58.

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• *NORTHERN PIEDMONT*: A sound slide program on an automatic absorption refrigeration machine was presented by R. S. Fullerton, branch manager, Carrier Corp., Charlotte, N. C.

A report on the Chapters Regional Committee Meeting for Region 5 was made by C. E. Amick, member of the Committee for Northern Piedmont Chapter. Pres. L. R. Gorrell was the presiding officer. Attendance 13. Attendance ratio 0.29.

• *OKLAHOMA*: Business conducted at the March meeting included the election of a nominating committee, with G. T. Doneel as chairman, and A. R. Morin and T. B. Wolfe, members. Unanimous approval was given by the membership to chapter by-law changes, proposed by R. B. Ellis, chairman, by-law committee, to allow conformity with the Society's By-Laws since the adoption of the Regional Plan of Operation.

The Plant Growing Laboratory at The California Institute of Technology was the subject treated by A. J. Hess, president, Hess Greiner & Polland, Los Angeles, Calif. Presented by W. J. Collins, Jr., Mr. Hess discussed his experiences and the problems in designing laboratories for studying growing plants. Although the design and equipment used were of primary interest, the audience also enjoyed learning the results of plant study. Mr. Hess, a great favorite of the Oklahoma Chapter, held a question and answer period for several minutes at the conclusion of his talk. Attendance 58. Attendance ratio 0.43.

• *ONTARIO*: Pres. D. L. Angus read the nominating committee report at the April meeting, attended by members of the Council and of the Chapters Regional Committee, who were in Toronto for the Regional Meeting.

Society Pres. John W. James, Chicago, extended his greetings to the large audience. Brief addresses were also given by P. B. Gordon, first vice president, New York, N.Y., and E. R. Queer, second vice president, University Park, Pa.

What Does the Owner Expect When He Buys Air Conditioning was the topic selected by a panel of speakers, with Bert Stott acting as moderator. The panel members were Harry Brown, of Mathers & Haldenby, architects; Robert Tamblyn, Canadian Ice Machine Co., Ltd.; L. Walford, of Wiggs, Walford, Frost & Lindsay, consulting engineers; and Ed Potter, of Angus, Robertson, Ltd., general contractors. A discussion period concluded the meeting. Attendance 196.

• *ONTARIO*: *Is the Steam Generating Unit Here to Stay?* queried J. E. Neilson, executive vice president, Foster Wheeler Ltd., St. Catherines, Ont., at the March meeting. Mr. Neilson's timely presentation was accompanied by slides.

F. G. Ewens introduced C. F. Smale, winner of the University of Toronto Thesis Award, which is offered by the Ontario Chapter to the student writing the best thesis on heating, ventilating or air conditioning. A letter from N. W. Kingsland, chairman, nominating committee, listing the nominees for next year was read by Pres. D. L. Angus. Attendance 120.

• *OREGON*: An enlightening insight into the effects of various supply duct arrangements for *Warm Air Perimeter Heating* in a structure with a concrete floor was given in a March coffee talk by H. C. Anders.

Following a short recess, the main speaker, D. B. Callaway, Industrial Sound Control, Inc., Beverly Hills, Calif., was introduced by O. W. Matthews. Mr. Callaway explained the advantages and disadvantages of the commonly used methods of silencing duct air noise, revealing that the engineered type of silencer requires a shorter length of lined duct.

J. E. Finkbeiner, O. W. Matthews, III, and H. H. Hewitt, Jr., were appointed as an auditing committee by Pres. Dick Blankenship, with Mr. Finkbeiner to act as chairman. A unanimous ballot elected the following officers: *President*—W. R. Norte; *Vice President*—W. B. Hayes; *Secretary*—G. G. Van Alst; *Treasurer*—T. H. McClung; *Board of Governors*—Dick Blankenship, R. L. Propst and Keith Kruchek to serve for the 1955-56 term. Attendance 60. Attendance ratio 0.31.

Newly Elected Ontario Chapter Officers (l. to r.) Charles Torry, vice president, H. R. Roth, secretary-treasurer, D. L. Angus, retiring president, and C. J. Bootes, president

• *OTTAWA VALLEY*: Elected as a nominating committee at the March meeting were V. D. Hossack, J. H. McCaughey, and S. C. Smith as chairman. Pres. E. J. Schoenherr announced receipt of a welcome invitation from the Montreal Chapter to join them at their annual spring golf tournament to be held on June 28.

Other features included a report by D. C. Smiley concerning the urgent appeal by the Indian Hospital at Moose Factory for toys for the Indian and Eskimo tubercular children patients. Mr. Smiley's personal description of conditions gained deeply interested reception.

Due to the postponement of the guest speaker's appearance, the evening was concluded with the showing of a film, *A Day in Court*. Attendance 23. Attendance ratio 0.38.

• *PACIFIC NORTHWEST*: A lively question period followed the presentation in March by D. B. Callaway, manager, Western Division, Industrial Sound Control, Inc., Beverly Hills, Calif., on *Noise Control in Ventilating and Air-Conditioning Systems*. Mr. Callaway's talk was considered to cover one of the most interesting and informative subjects presented to the chapter.

L. F. Christofferson, first vice president, reported on the 62nd Annual Meeting and

GORDON ATTENDS CONVENTIONS

As official Society representative, First Vice Pres. P. B. Gordon attended the Annual Convention of the Mechanical Contractors' Association of America in Louisville, May 14-18, and also found time to be present at the Annual Meeting and Convention of the New York State Society of Professional Engineers in New York on May 19th.

P. B. Gordon
New York, N. Y.

Mr. Gordon also presented a paper on air conditioning at the Annual Meeting of the National District Heating Association at Williamsburg, Va., held during the first week of June. On that occasion also, Mr. Gordon spoke to the meeting on behalf of ASHAE.

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the Regional Meeting held at Portland, which he attended as a member of the Chapters Conference Committee and Chapters Regional Committee for Region 4, respectively. The results of a questionnaire seeking the preferences of chapter members were announced by Pres. P. I. L. Winsor. Attendance 61. Attendance ratio 0.41.

• *PHILADELPHIA*: H. E. Voegeli, development engineer, American Brass Co., Waterbury, Conn., spoke at the March meeting on *Stored Solar Heat and the Heat Pump*.

A report on the new Regional Plan was given by John Everetts, Jr., regional director for Region 1. Pres. A. M. Robertson was the presiding officer. Attendance 74.

• *PITTSBURGH*: After reading the report of the nominating committee, Pres. C. L. Benn turned the March meeting over to E. J. Busch, program committee chairman. Mr. Busch introduced C. S. Stock, manager, unit ventilator department, American Air Filter Co., Louisville, Ky., who addressed the group on *The Heating and the Ventilating of the Classroom*. Mr. Stock gave the first report made on the Washburn School, Auburn, Me., accompanying his talk with several slides of this unusually designed school. Attendance 80.

• *ROCKY MOUNTAIN*: Excerpts from a letter sent by B. H. Spurlock, Jr., who is presently serving under a Fulbright grant as a lecturer and consultant at the College of Engineering, Baghdad, Iraq, were read by Secy. W. V. Burbank at the March meeting. Professor Spurlock, who is working part time following recovery from his recent illness, expressed appreciation for all the cards and letters sent to him while in Beirut, Lebanon.

Pres. L. L. DeLong told of his attendance at the 62nd Annual Meeting, and Leo Krisl, chairman of the nominating committee, presented the slate of nominees.

The speaker, H. A. Lockhart, vice president of engineering, Bell & Gossett Co., Morton Grove, Ill., was introduced by A. S. Widdowfield, program chairman. The subject chosen was *High-Temperature Hot-Water Heating*, with coverage of the advantages of such heating, and discussion of various locations for the circulating pump. A 15-minute discussion period followed Mr. Lockhart's presentation, and even after the meeting was adjourned several members and guests continued the informal discussion. Attendance 79. Attendance ratio 0.31.

• *ST. LOUIS*: The editorial director of *Air Conditioning and Refrigeration News*, P. B. Redeker, spoke in March on *Distribution Problems in the Air-Conditioning Field*. Since this was a joint meeting with the St. Louis Section of *ASRE*, J. E. Dube, regional director of *ASRE*, introduced the speaker.

E. T. Chicas, president, ASHAE St. Louis Chapter, and B. M. McDougall, chairman, *ASRE* St. Louis Section, introduced the officers of their respective groups. President Chicas appointed B. L. Evans to the nominating committee. Attendance 105.

• *SOUTH CAROLINA*: A talk on schoolhouse heating was given in March by W. B. Southerlin, supervisor, schoolhouse planning, State Educational Finance Commission. W. O. Blackstone introduced the guest speaker.

Members selected to serve on the nominating committee were T. O. Curlee, Jr., I. C. Harrison, H. W. Hood and Harry McKeown, with W. O. Blackstone as temporary chairman, and J. H. Patterson and F. G. Franklin as alternates.

Treas. H. J. Haar, Jr., read a report prepared by Pres. R. K. Rouse regarding the Regional Meeting held in Atlanta, and an invitation from the Southern Piedmont Chapter to attend their meetings. A motion was carried directing that a letter of appreciation be sent to M. R. Durlach, Jr., for his efforts in bringing about the February joint meeting, Columbia. Attendance 35. Attendance ratio 0.42.

• *SOUTHERN CALIFORNIA*: Using formulas, graphs and equations, W. C. Hurty, professor of engineering, University of California at Los Angeles, demonstrated at the March meeting the problems in vibration control for air conditioning equipment. Numerous questions asked after his talk were ably answered by Professor Hurty.

Pres. J. L. McCullough gave an enthusiastic report on the Regional Meeting held in Portland. His commendation of the success of this meeting was seconded by A. Z. Levine, W. J. Biggar, R. W. Thomas and W. O. Stewart.

Elected to the nominating committee were Mr. Stewart, L. J. Helms, J. S. Earhart, L. B. Davenport and J. F. Park. Attendance 107.

• *SOUTHERN PIEDMONT*: The fabrication of and future possibilities for *Pre-Stressed Concrete* were discussed by Peter Verna, president, Concrete Materials, Inc., Charlotte, N. C., who was introduced by Program Chairman C. E. Petty at the March meeting.

Several of the points covered at the meeting of the Chapters Regional Committee for Region 3 were reported on by W. P. Wells and G. C. Garrett. Attendance 26.

• *TOLEDO*: The guest speaker at the April meeting, M. A. Ramsey, Worthington Corp., Harrison, N.J., was introduced by Robert Greenwald. Mr. Ramsey discussed *Heating and Air-Conditioning Experience in South America*.

A short talk on *Engineers and Their Relationship to People* was given by E. R. Queer, second vice president of the Society, University Park, Pa. C. F. Hoffman, president of the Toledo Chapter, introduced Professor Queer to the attending members and guests.

Names submitted by the nominating committee were read by President Hoffman. Attendance 45.

Taken at the Toledo Chapter meeting, April 2, 1956. Robert Greenwald, chairman program committee, and M. A. Ramsey, guest speaker

• *TOLEDO*: A travelogue composed of colored slides taken on trips to Italy and Spain was given in March by B. G. Silberstein, district manager, Hg Electric Ventilating Co., Cincinnati, Ohio. R. J. Frith presented Mr. Silberstein to the audience of members and a large number of guests.

A motion directing the president to name a nominating committee was carried. Vice Pres. J. F. Heilman presided. Attendance 97. Attendance ratio 0.41.

• *WASHINGTON, D. C.*: The topic covered by the March guest speaker was the design and installation of radiant panels, which could be used for heating, cooling and sound conditioning. C. W. Holliday introduced the speaker, Leo Linsenmeyer, engineer, Burgess-Manning Co., Chicago, Ill., whose talk was well received.

P. R. Achenbach, general chairman, Committee on Arrangements, Semi-Annual Meeting 1956, reported on the Regional Meeting held in Atlanta, and told of the progress being made by the various committees which are preparing for the Semi-Annual Meeting. G. R. Walz, chairman,

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nominating committee, listed the nominees for 1956-1957 offices proposed by his committee. Attendance 60.

Purdue Student Branch Visits Louisville

Nineteen members of the Purdue Student Branch, together with Prof. F. B. Morse, faculty advisor, drove to Louisville, Ky., where they inspected the plants of American Air Filter Co., Inc., General Electric Co., and The Marley Co., April 6 and 7.

The students who attended are: R. F. Puncochar, coordinator; Dick Schultz, Bob Kuester, Bob Lawinger, Stan Van Meter, John W. Deabler, secretary; Joe Johnson, Chet Piontek, Bill Spick, Bill Scholten, Neil Johnson, Rip Vail, Rich Eibel, Frank Parrone, Don Doucette, president; Stan Wagner, Jack Bittner, and Bill Goette.

The trip proved a most enjoyable one as well as instructive. The companies were exceedingly hospitable and showed the group an excellent time. Attendance ratio 0.63.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 65 men who are candidates for membership, or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before June 30, 1956, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: †Reinstatement *Advancement

California (*Region* 4)

BOND, C. V., Chief Engr., Key Refrigeration Co., Inc., El Monte.

DUNN, G. W., Jr., Cons. Mech. Engr., San Diego.

PETICOLAS, L. D.†, Partner, The E. I. E. Co., Cons. Engrs., Los Angeles.

WILLIAMS, E. H., Jr., Engr., Fraser & Johnston Co., San Francisco.

Colorado (*Region* 3)

FEAST, C. N., Asst. to Vice Pres., Construction Specialties Co., Denver.

Connecticut (*Region* 1)

MONDEL, W. A., Gen. Mgr., James V. Lesiur Co., New Haven.

SEALE, J. G.†, Mfrs. Repr., Ridgefield.

District of Columbia (*Region* 5)

KOOISTRA, J. F.†, Repr., Carrier Corp., Washington.

Georgia (*Region* 5)

MUNDY, J. T., Partner, Brewer & Mundy Engineering Co., Atlanta.

SAWYER, L. A., Engr., Sales Dept., Carrier Atlanta Corp., Atlanta.

Illinois (*Region* 2)

BURCHARDT, J. C., Pres., Anker Corp., Chicago.

PANZA, J. E., Asst. Chief Engr., Powers Regulator Co., Skokie.

Kentucky (*Region* 5)

DILLEHAY, H. D., Mech. Engr., Brock-McVey Co., Inc., Lexington.

Louisiana (*Region* 5)

MAYERS, A. L., Jr.*, Partner, Whipple & Mayers, Cons. Engrs., Baton Rouge.

MERWIN, W. J., Secy. & Treas., Reilly-Benton Co., Inc., New Orleans.

Michigan (*Region* 2)

CLEARY, R. B.*, Prof. Engr., Earl L. Confer, Archt., Detroit.

KANN, G. D., Jr., Prod. Design Engr., Ford Motor Co., Royal Oak.

KINGSCOTT, R. R.*, Chief Engr., Louis C. Kingscott & Assoc., Inc., Kalamazoo.

Minnesota (*Region* 3)

LAMP, G. H., Jr., Prod. Appl. Engr., American Air Filter Co., Inc., Minneapolis.

MILLER, R. E., Mgr., American-Standard Corp., Minneapolis.

PHILLIPS, R. D., Mfrs. Repr., Air Conditioning Equipment Co., Minneapolis.

RYAN, T. A., Repr., American Radiator & Standard Sanitary Corp., Kewanee Boiler Div., Minneapolis.

Nebraska (*Region* 3)

ALBERT, D. A., Dist. Mgr., Surface Combustion Corp., Omaha.

CALDWELL, E. D., Mech. Engr., Leo A. Daly, Co., Omaha.

COFFEY, T. A., Mech. Engr., Strategic Air Command, Omaha.

New Jersey (*Region* 1)

FISHMAN, N. L., Sales Engr., Philip H. Werner, Irvington.

New Mexico (*Region* 6)

BURNSWORTH, V. D., Pres. & Gen. Mgr., Air Conditioning Equipment Co., Albuquerque.

STEPHENS, V. J., Mech. Engr., Los Alamos Scientific Laboratory, Los Alamos.

SUNDQUIST, C. T., Cons. Planning Engr., Los Alamos Scientific Laboratory, Los Alamos.

New York (*Region* 1)

BERGERON, P. O., Htg. Field Repr., Crane Co., Long Island City.

COOK, H. L., Htg., Vtg. & A.C. Engr., Cedric R. Acheson, Cons. Engr., Syracuse.

CROCHE, A. L.*, Pres., Associated Thermal Products, Inc., New York.

DYCE, G. A., Owner, G. A. Dyce Heating & Air Conditioning Contractor, Buffalo.

EGBUN, B. N., Sales Engr., Westinghouse Electric Corp., Sturtevant Div., New York.

FRASER, V. H., Engr., Cedric R. Acheson, Cons. Engr., Syracuse.

MCKEE, C. H., Mech. Designer, Port of New York Authority, New York.

ROSENBERG, F. S., Repr., H. E. Rieckelman, Co., Buffalo.

SOFFLER, ALVIN, Sales Engr., Carleton Stuart Corp., New York.

WISE, J. F., Mgr., Htg. Sales, Crane Co., Long Island City.

North Carolina (*Region* 5)

JUSTICE, G. A., Jr. Engr., B. O. Vannort, Engrs., Charlotte.

MILLER, F. C., Indus. Piping Div., Grinnell Co., Inc., Charlotte.

Ohio (*Region* 2)

BUTLER, R. W., Sales Engr., American Blower Corp., Cleveland.

CLARK, F. R., Field Engr., Johnson Service Co., Cleveland.

DUNN, R. R., Engr., Chrysler Corp., Airtemp Div., Dayton.

GORE, SEYMOUR, Treas., Home & Industrial Heating Co., Cleveland.

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MAZZARELLA, RICHARD, Sales Engr., Johnson Service Co., Cleveland.

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Gamble, R. L., Sales Dept. Mgr., Crane Co., Seattle.

Harlow, C. W., Refrig. Foreman, Brown-Johnston Co., Spokane.

Luhn, R. R., Design Engr., Lyle E. Marque & Assoc., Spokane.

Neudorfer, R. F., Repr., R. E. Chase & Co., Seattle.

Schafer, S. A., Secy.-Treas., Bernhard & Schafer Inc., Spokane.

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Campbell, G. N., Utilization Engr., Northwestern Utilities, Ltd., Edmonton, Alta.

Daum, P. G., Gen. Mgr., Tacey Sheet Metal, Ltd., Vancouver, B. C.

Gilbert, André, Partner, Fortin & Gilbert, Cons. Engrs., Quebec, Que.

Hackett, D. J., Mgr., Htg. Div., Empire Brass Co., Ltd., London, Ont.

Holden, J. C., Design Engr., Wood, McAdam & Magor, Cons. Engrs., Westmount, Que.

Jacques, P. E., Repr., Douglas Engineering Co., Ltd., Quebec, Que.

Levesque, L. A., Repr., Control Equipment Co., Ltd., Montreal, Que.

Marsh, E. W. G., Estimator, Cumming Galbraith Ltd., Edmonton, Alta.

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Price, G. E., Sales Engr., Canadian Johns Manville Co., Vancouver, B.C.

Spence, F. R., Sales Mgr., Masdom Corp., Ltd., Montreal, Que.

Wigmor, E. L., Mgr., Toronto Branch, Atlas Webster Industries, Ltd., Toronto, Ont.

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Tauss, Walter, Cons. Engr., Perth, Western Australia.

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OBITUARIES

CHARLES F. DONOHOE
Detroit, Mich.

After a long illness, Charles F. Donohoe, technical engineer, The Detroit Edison Co., Detroit, Mich., died recently in Lorain, Ohio, his birthplace 47 years previous.

Mr. Donohoe joined The Detroit Edison Co. following graduation from Carnegie Institute of Technology. Except for two years in the Research Laboratory, his lengthy connection with the company was spent in the central heating department.

Besides membership in the Society since 1941, Mr. Donohoe held membership in Theta Xi Fraternity and had been a member of the *Engineering Society of Detroit* and the *National District Heating Association*.

Surviving are his wife, Lavina; his sons, William C. and Gerald A.; his parents, Mr. and Mrs. M. L. Donohoe and two sisters. He had made his home in Huntington Woods, Mich.

EDGAR HERRING
London, England

A Life Member of the Society, Edgar Herring, M. I. Mech. E., chairman, J. Jeffreys Co. Ltd., London, England died on March 12, 1956. He had had a serious illness shortly before the last world war which necessitated his retirement from an active life. He was 88.

Mr. Herring was born March 20, 1868, in London, and was educated at Putney High School and Richmond-on-Thames Grammar School. He was apprenticed in 1883 for six years to John Jeffreys, heating engineer, and remained to become, successively, chief assistant, partner, managing director and chairman of the firm. Mr. Herring was connected, through J. Jeffreys Co., Ltd., with the design and execution of heating and ventilating for many famous public buildings including Victoria and Albert Museum in London.

A member of ASHAE since 1919, and made Life Member in 1938, Mr. Herring was also a member of the *Institution of Mechanical Engineers*, London, and a past president (1918-1920) of the *Institute of Heating and Ventilating Engineers*, London.

His home was in Putney, a suburb of London.

CHARLES A. HOPPIN, SR.
St. Louis, Mo.

Charles A. Hoppin, Sr., sales engineer, Stoker Oil Burner Service Co., St. Louis, Mo., died of a heart attack on Sunday, March 18, 1956, at the home of his son, C. A. Hoppin, Jr., in Chesterfield, Mo.

Mr. Hoppin was a member of the Society since 1946, and was a graduate of the University of Illinois, Urbana, Ill., with a degree of B.S. in Mechanical Engineering. He began his business career in 1901 with Allis-Chalmers Manufacturing Co., Milwaukee, Wis., later going, in 1909, to the Central Illinois Light Co., Peoria, Ill., as chief engineer and general superintendent. He became partner in, and president of, Hoppin and Rich and C. A. Hoppin & Co.,

Journal Section

Peoria, Ill., in 1915, subsequently joining Parker-Russell Mining and Manufacturing Co., St. Louis, Mo., as sales engineer in 1928. After initiating his own business in sales and contracting, Mr. Hoppin joined the Laclede Co., St. Louis, Mo., in 1932 and retired in 1952 after 20 years of service with them as senior engineer and manager, sales engineering and research.

Mr. Hoppin is survived by his two sons, C. A. Hoppin, Jr. and John H. Hoppin, and a daughter, Miss Betsy Hoppin.

WILLIAM STEIN
New York, N.Y.

The Society has received word of the recent death of William Stein, chief engineer of the Industrial Stoker Division, Combustion Engineering Co., New York, N. Y. Mr. Stein, who was 66 years old at the time of his death, had been a member of the Society since 1916.

Born in Schenectady, N. Y., he attended Schenectady High School and New York Preparatory School, graduating from the latter in 1911. He worked for the General Electric Co. in Schenectady for four years before returning to study at New York University. Mr. Stein joined the Combustion Engineering Co. in 1917 and remained with them for thirty nine years, until his death. For the last twenty years he served as chief engineer of the Industrial Stoker Division.

He is survived by his widow, Charlotte, who resides in Flushing, N. Y.

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(62 Chapters: 1 Special Branch: 6 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, J. B. Hoagland, 1923 W. Osborn Rd. SECY, F. W. Gabbard, 111 East 14th St., Tempe.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, J. L. Brown, 212 Terminal Warehouse Bldg. SECY, H. H. Himstedt, 510 E. Third St.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, D. E. McLeod, 2415 Green St. (23). SECY, Herb Duncan, 938 N. Linden Ave., South San Francisco.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, R. A. Sarro, 5412 Argo Way (21). SECY, M. J. Delavan, 405 Meister Way (19).

Southern California: 1936. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, R. F. Uloves, 3680 Olympiad Dr. (43). SECY, A. Z. Levine, 273 S. Oxford Ave. (4).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, A. S. Widdowfield, 1925 Blake St. (2). SECY, R. T. Beck, 1964 Cherokee St. (4).

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, E. J. Hoagland, 16 Oakwood Ave., West Hartford (7). SECY, J. D. Pierce, 775 Capitol Ave., Hartford.

DISTRICT OF COLUMBIA

Washington: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, J. H. Broome, 4926 Wisconsin Ave. (16). SECY, J. W. Morgan, 2117 M Street, N.W.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, T. A. Barrow, Jr., 302 Ponce de Leon Ave., N.E. (8). SECY, J. A. Marshall, 1415 Howell Mill Rd., N.W.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, G. G. Freyder, 72 W. Adams St. (90). SECY, Herbert Kreisman, 117 N. Desplaines St. (6).

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, J. W. Jackson, 1531 N. Pennsylvania St. (2). SECY, G. W. Vogel, 31 E. Georgia St. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, G. J. Kraai, 907 Sixth Ave. (14). SECY, W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, A. B. Newton, 3511 Elmwood Dr. (17). SECY, T. L. Roberts, 2006 S. Parkwood Lane (18).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. M. Pace, 218 Don Allen Rd. (7). SECY, R. B. Duggan, 41 Beechwood Rd., Jeffersonville, Ind.

LOUISIANA

Baton Rouge: 1953. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, C. S. Woodruff, P.O. Box 356. SECY, A. J. Mayers, Jr., 440 N. Foster Dr. (6).

Delta: 1953. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, W. B. Martin, Jr., 635 Commercial Pl. (12). SECY, R. K. Goode, 4052 Thalia St. (25).

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, R. S. Segall, 848 River Rd. SECY, A. L. Jones, Jr., 754 Gladstone.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, E. J. Morris, 813 N. Calvert St. (2). SECY, L. J. Dull, 1122 N. Charles St. (1).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, G. D. Fife, 79 Milk St. SECY, R. F. Curry, 80 Ripley St., Newton Centre (59).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, R. E. Cross, 114 Boston Rd. SECY, F. A. Ferraro, 172 Chestnut St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, D. S. Falk, 4804 Woodward Ave. (1). SECY, J. H. Spitzley, 1200 W. Fort St. (26).

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, F. L. Murray, 48 W. Michigan Ave., Battle Creek. SECY, R. J. Waankes, 500 E. 8th St., Holland.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets, 1st Mon. PRES, E. T. Erickson, 500 Investors Bldg. (2). SECY, J. H. Jester, 621 E. Hennepin Ave.

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, B. L. Palmer, 1808 N. Mill St. (2). SECY, M. F. Knipp, Jr., 2858 Arbor Hill Dr. (4).

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, A. S. Hurt, Jr., 9601 E. 18th St. (27). SECY, S. C. McCann, 210 W. Tenth St. (5).

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, E. T. Clucas, 4954 Olive St. SECY, N. J. Hubbuch, Jr., 7020 Cornell, University City (5).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, T. E. Davis, 4303 Dodge St. SECY, C. A. Failer, 1802 Mason St. (2).

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, W. C. Kruse, Jr., 183 N. 19th St. (7). SECY, S. H. Nitzberg, P.O. Box 157, Wood-Ridge.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Mon. PRES, H. F. Munn, 419 Granite, N.W. SECY, J. K. James, 4462 Avenida del Sol.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, H. J. Morton, 122 Lincoln Ave. SECY, E. L. Moyer, R.D. 2, Jamesville.

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, L. V. Appleby, N. Pearl & Van Woert Sts. (4). SECY, E. J. Mahoney, 45 Colvin Ave.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, Albert Giannini, 385 Madison Ave. (17). SECY, Carl H. Fink, 62 Worth St. (13).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, C. W. Kaupp, 271 Delaware Ave. (2). SECY, J. P. Guerra, 34 E. Depew Ave. (14).

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd Fri. PRES, J. F. Gorrell, 1412 Chester Rd., Raleigh. SECY, C. E. Amick, 1042 Garmont Ave.

Southern Piedmont: 1952. Hdqrs., Charlotte. PRES, J. A. Rice, 719 E. Worthington Ave. SECY, E. D. Streng, P.O. Box 4063.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon., PRES, R. A. Wilson, 2240 N. High St. SECY, T. R. Walker, 182 N. Yale Ave.

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, A. H. Gerdsen, 224 E. Second St. (2). SECY, T. D. Reiley, 1905 Dunlap St. (14.)

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, D. E. Tullis, 1720 Parkhill Drive (6). SECY, L. P. Brehm, Jr., 111 S. Broomfield Rd.

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, L. C. Burkes, 1792 E. 40th St. SECY, R. A. Urban, Sr., 1740 E. 12th St. (14).

Toledo: 1954. Hdqrs., Toledo. PRES, J. F. Guest, 1815 N. 12th St. SECY, Robert Greenwald, 2525 Portsmouth Ave. (13).

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, J. R. Patten, 1726 N.W. Fifth (6). SECY, A. C. Shelley, 2946 Nimitz (12).

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, H. W. Meinholtz, Box 2261. SECY, H. L. Cauvel, 3342 East 41st St.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. R. Norte, 2225 N. E. Broadway (12). SECY, G. G. Van Aist, 947 S. E. Market.

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, C. J. Lubking, 3545 W. Hunting Park Ave. (32). SECY, Ludwig Mack, 412 W. Hortter St. (19).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, C. L. Benn, 420 Blvd. of Allies (19). SECY, E. H. Riesmeyer, Jr., 231-33 Fort Pitt Blvd. (22).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. PRES, R. K. Rouse, P.O. Box 3731, Greenville. SECY, B. A. Leppard, P.O. Box 3353, Station A, Greenville.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, W. L. Henson, 496 S. Main St. SECY, G. B. Ramsey, Jr., 157 Neil St. (3).

TEXAS

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, H. G. Gregerson, 4512 Livingston (5). SECY, Ross Zumwalt, 923 Mercantile Securities Bldg. (1).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, F. M. Neil, P.O. Box 13197 (19). SECY, A. B. Ullrich, 2520 Huldy St. (19).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, F. B. Frazee, 1013 Riverside Dr., Austin (4). SECY, J. L. Rea, Jr., 300 West 6th St., Austin.

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, J. C. Wharton, P. O. Box 1240. SECY, D. G. Hailey, 3606 Ave. A.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, R. C. Evans, 2549 Wilmington Ave. (6). SECY, G. E. Wright, Jr., Dooly Bldg.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, C. G. Conaway, Jr., 7454 Hunt Ave. (5). SECY, E. R. Simpson, Jr., 720 Guy St.

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, F. W. Jenkinson, W. 524 Fourth Ave. (4). SECY, J. A. Doyle, W. 3018 Broad.

Pacific Northwest: 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, P. J. L. Winsor, 20031 Marine View Dr., S.W. (66). SECY, M. W. McKinstry, 4017 McGilvra St. (2).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, I. J. Kossiter, 231 W. Wisconsin Ave. (3). SECY, R. D. Rodwell, 152 W. Wisconsin Ave. (3).

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, Cornelius Van Boeyen, 636 Drake St. (3). SECY, A. C. Martin, 425 W. Second Ave.

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, G. C. Davis, 212 Waverly St. (9). SECY, A. H. Millar, 342 Mandeville St., St. James (12).

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, S. R. Pramondon, City Planning Dept., Smoke Control Division, City Hall. SECY, Arthur DeBreyne, 9 St. Denis St., St. Lambert.

Northern Alberta: 1956. Hdqrs., Edmonton. PRES, W. C. Woods, 13908 116 Ave. SECY, L. K. Cumming, 10249 104 St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, D. L. Angus, 25 Bayview Wood. SECY, H. R. Roth, 57 Bloor St., W.

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, L. J. Schoenherr, 32 Clarey Ave. (1). SECY, C. W. Watson, 102 Bank St.

SPECIAL BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Walter Haussler, Lrbstrasse 2, Kusnacht. SECY, L. F. de Bruyn, Muhlebachstrasse 172 (8).

STUDENT BRANCHES

North Carolina State College: 1948. Hdqrs., Raleigh. PRES, P. K. Tuggle, 407 Gray St., Kannapolis. SECY, G. L. Wadman, P.O. Box 3790, North Carolina State College.

Oregon State College: 1949. Hdqrs., Corvallis. Meets, 1st Wed. after 1st Tues. PRES, P. I. Anderson, 202 N. 10th. SECY, D. W. Strahan, 233 Mall St.

Purdue University: 1948. Hdqrs., W. Lafayette, Ind. PRES, D. B. Doucette, Purdue Student Branch, ASHAE, School of Mech. Engrg. SECY, J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

Texas A. & M. College: 1946. Hdqrs., College Station. Meets, 2nd and 4th Tues. PRES, D. F. Carroll, Box 6264. SECY, C. W. Farrar, Jr., Rt. 1, Box 399, Bryan.

University of Detroit: 1949. Hdqrs., Detroit. Meets, 1st Tues. PRES, L. J. Hayes, Jr., 16254 Santa Rosa Dr. (21). SECY, L. F. Hoelscher, Jr., 14283 Cherrylawn (38).

University of Toronto: 1951. Hdqrs., Toronto. PRES, C. F. Smale, 347 Kennedy Ave. (9). SECY, T. D. Digel, 204 King St., Weston.

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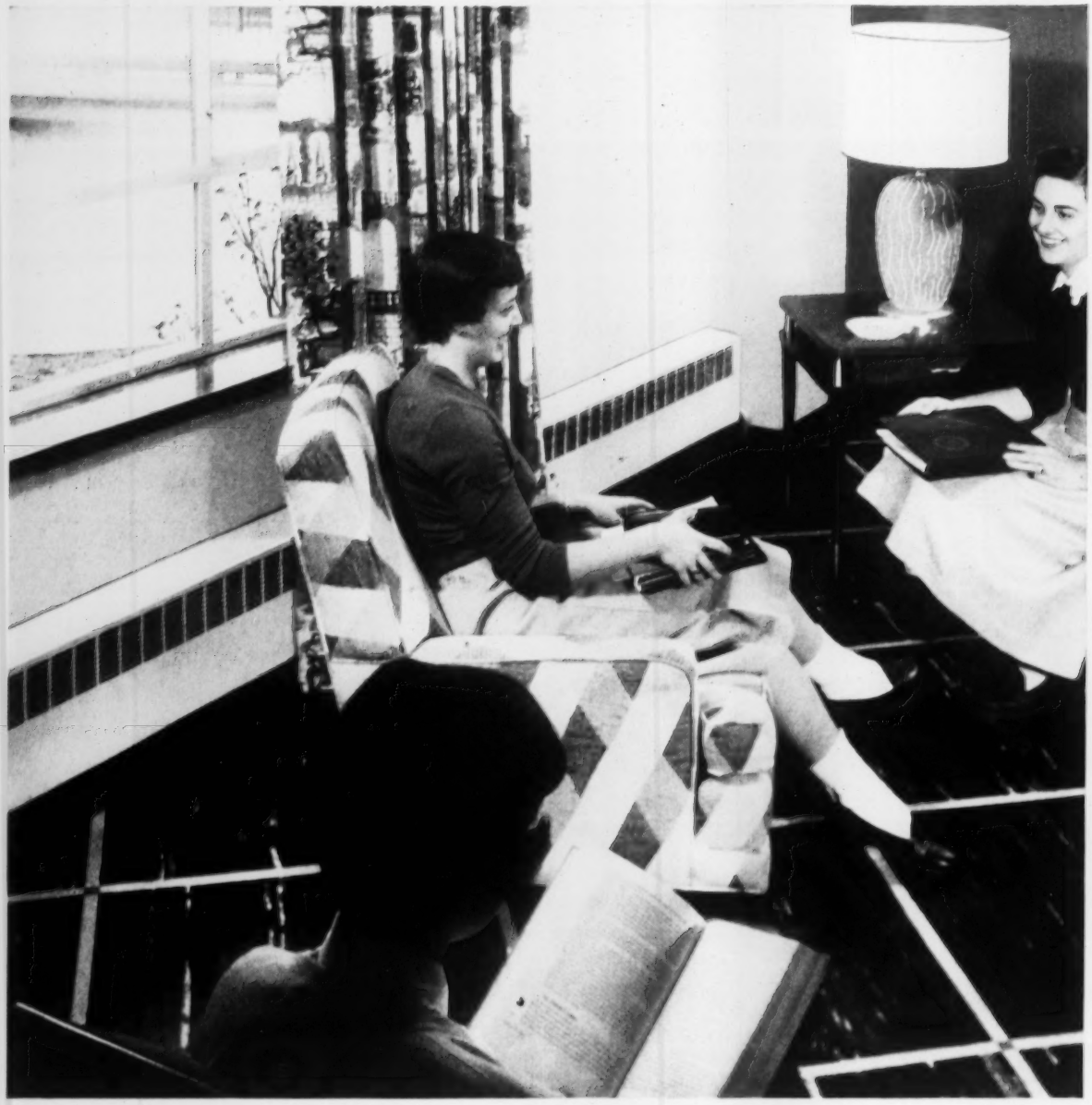

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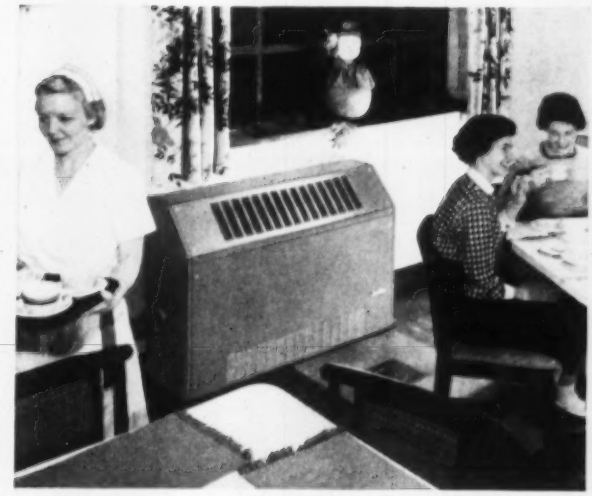
Architect: William York Cocken, Pittsburgh, Pa.

General Contractor: Duquesne University Department of Engineering, Pittsburgh, Pa.

Duquesne University knows that it pays to depend on DUNHAM



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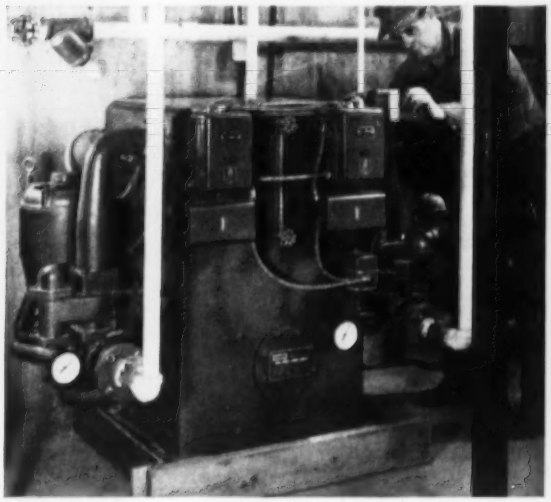

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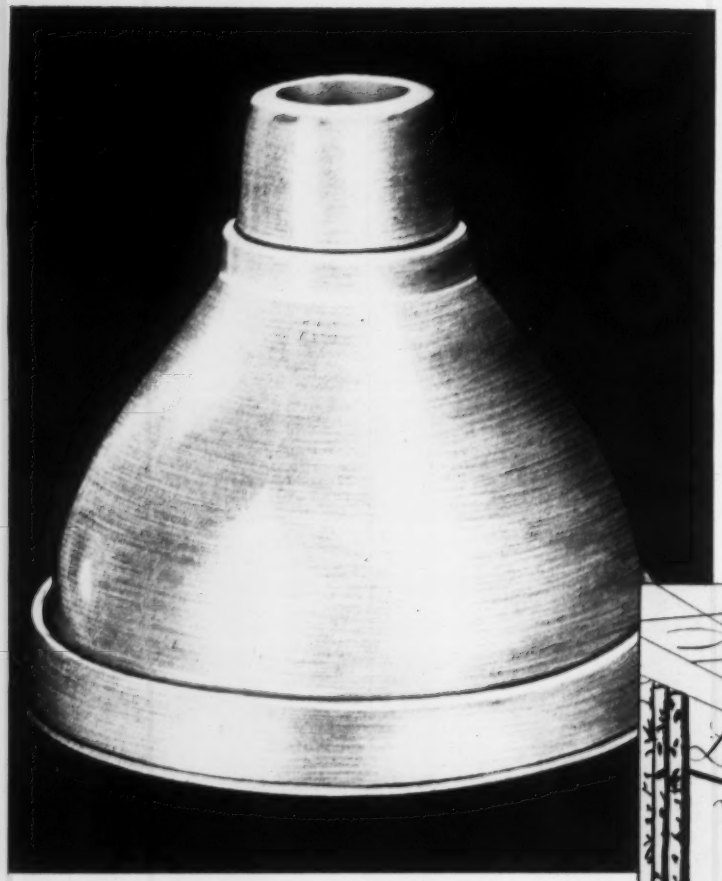

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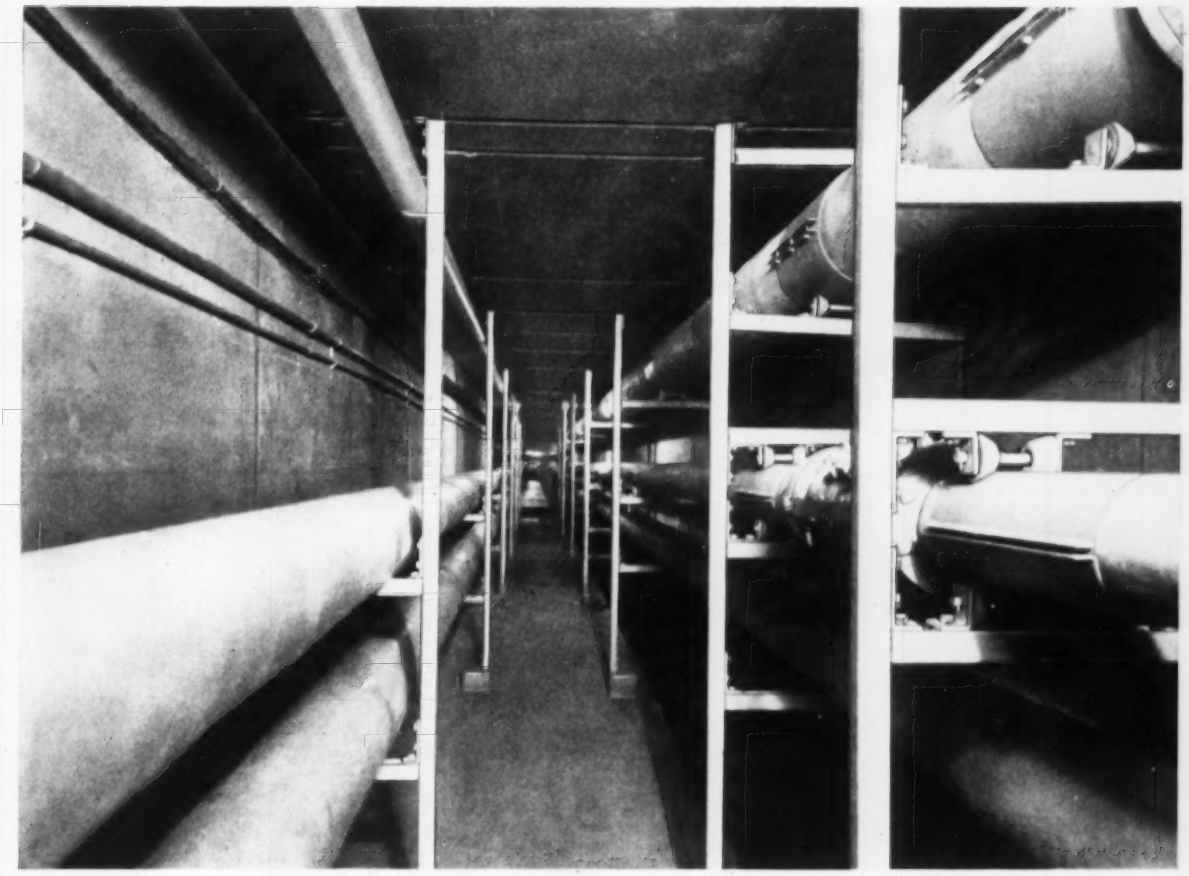

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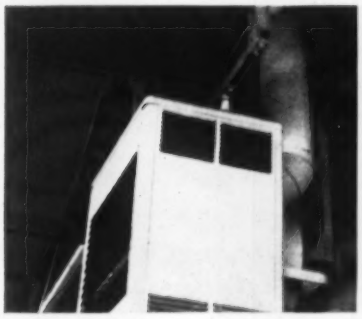
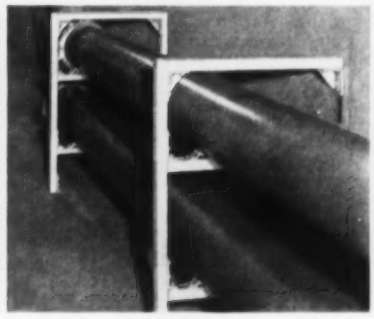


UNISTRUT framing—with UNISTRUT concrete inserts—supporting heavy water and sludge lines.



U. S. Patent Numbers 2327587 2329815 2380379 2363382 2345650 2541908 2405631 2696135 Other Patents Pending

Nesbitt

CONFIDENTIAL

Interoffice Memorandum

You've proved it — Print it — A.J.N.

Date March 7, 1956

To All Nesbitt Sales Offices — From Philadelphia - H. B. Hedges — Office

Office — Order No.

Subject Engineering Dept. Tests on Series T Surface (Pub. 345-1)

1. Attached to this memo is a copy of the Engineering Department's new printed report, "An Investigation of Performance of Nesbitt Series T Surface".

2. NOW FOR THE FIRST TIME - PUBLISHED DOCUMENTARY DATA PROVING THE CLAIMS OF UNIFORM DISCHARGE TEMPERATURES AND CONDENSATE FREEZE PROTECTION UNDER MODULATED STEAM CONTROL.

3. The facts of these tests so far exceed our anticipated results on the TROMBONE Steam-Distributing Tube Surface that the decision to publicize this information will have to come from A. J. Nesbitt. For the present, therefore, I am marking this memo CONFIDENTIAL.

4. The significance of these tests lies in the fact that the TROMBONE Steam-Distributing Tube Surface exhibited [illegible] in the field of condensate freeze protection, and simultaneously [illegible] tremendous advance in the field of steam distribution.

5. TROMBONE Steam-Distributing Tube Heating Surface has given a NEW meaning to the old term "even steam distribution". Now this term applies to all positions of the steam valve and not just to valves at wide open position.

6. [illegible] engineering friends will quickly note that here is [illegible] new type of heating surface that maintains [illegible] of control of discharge temperatures at the place where it is most needed - under conditions of modulated control.

7. TROMBONE Steam-Distributing Tube Heating Surface has as much application in reheaters as in preheaters because it provides a positive means of accurate control even in surface sections of 10-foot finned length.

8. This is the greatest and most convincing series of tests ever made within my knowledge of 40 years in the industry.

Berkley Hedges

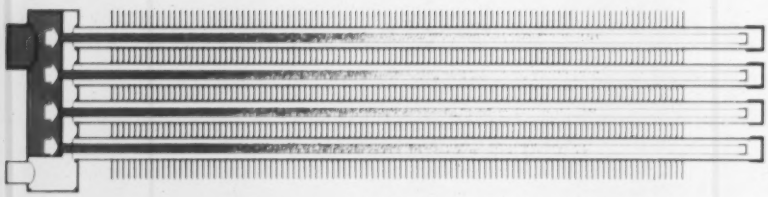
NOW...

to get these results specify NESBITT Series T Heating Surface with the TROMBONE Steam Distributing Tubes

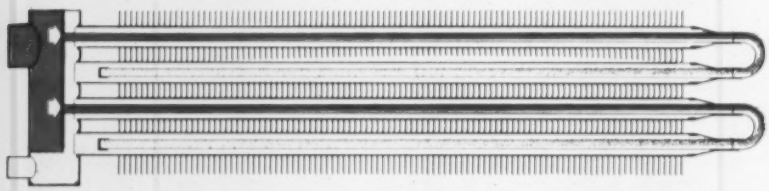
This is NEWS — a series of tests that proves conclusively the broad claims made for Nesbitt Series T Heating Surface: *uniform final temperatures* and *maximum freeze protection over the entire capacity range* — from 100% down to the smallest practicable supply of low-pressure steam under valve control.

Each trombone steam-distributing tube serves two adjacent condensing tubes from a single supply-header connection. Steam must travel across the first leg of the trombone tube (full length of the surface) before reversing, under increased demand, to serve the second leg.

Send for this report (345-1) and Publication 305 to learn why Nesbitt Series T Surface is unmatched for your heating and ventilating use with modulating valve control.



Conventional Surface: Steam apportioned to all tubes in the coil. With a small steam flow, air near supply end is heated; near return end, air is unheated. Results: temperature stratification; condensate subject to freezing.



Nesbitt Trombone Surface: Steam apportioned to *every other* tube. The same steam quantity goes *twice as far* in each tube. Even small quantities are distributed over entire surface area. Results: uniform final temperatures, full length of coil; freeze protection; perfect control with modulating valves.

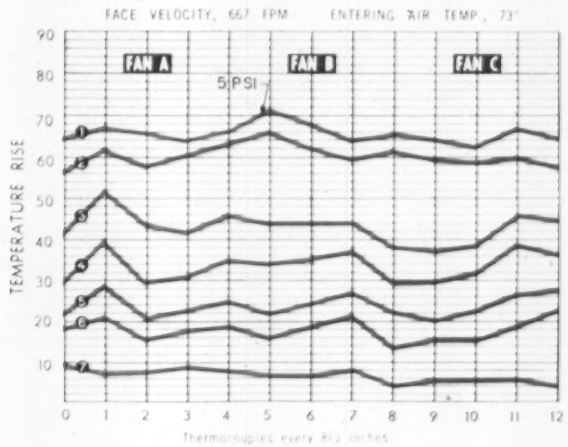
Nesbitt Series T HEATING

ADVERTISEMENT
of John J. Nesbitt, Inc.
Philadelphia 36, Pa.

FOR THE FIRST TIME

. . . published documentary data proving the claims of uniform discharge temperatures and condensate freeze protection under modulated steam control

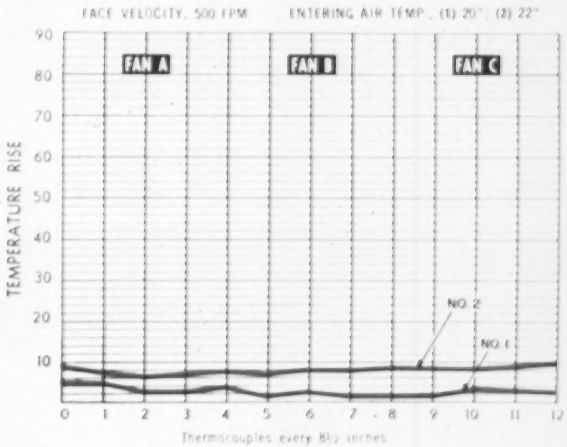
Uniform Discharge Temperatures – Reheating



Curve	Fan Discharge Temperatures A	B	C	Average Rise	% Capacity
1	136	137	137	63.7	100.0
2	129	131	131	57.3	90.0
3	115	116	116	42.7	67.0
4	107	103	106	32.3	50.7
5	97	94	95	22.3	35.0
6	89	89	89	16.0	25.1
7	77	78	78	4.7	7.4

The graph shows that the steam was distributed across the entire length (10 feet) of 2-row surface even under extreme modulation. Fan discharge temperatures were almost constant. This is normal operation for Nesbitt Series T.

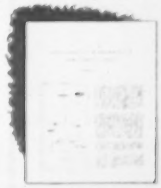
Condensate Freeze Protection – Preheating



Curve	Fan Discharge Temperatures A	B	C	Average Rise	% Capacity
2	29	28	29	6.7	7.46
1	23	22	22	2.3	2.56

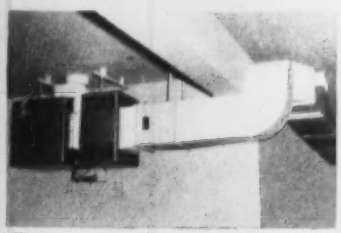
This is an extreme test with only a cracked valve; entering and leaving air both sub-freezing. Perfect distribution with only 2.56% of capacity; no condensate freezing nor leaks.

Send for this publication
(No. 345-1) It gives complete information of amazing tests that prove Series T claims.



SURFACE WITH TROMBONE STEAM DISTRIBUTING TUBES

CHERRYWOOD SHOPPING CENTER, WANTAGH, L. I., with 25 stores. One of many in the Long Island area designed and built by Berger & Tilles, who have standardized on Janitrol Unit Heaters. Heating Eng. M. Prop; Heating Contractor, Metropolitan Sheet Metal Co., Elmhurst, L.I.



This blower-type Janitrol unit feeding a duct system is typical of the modern heating provided stores at Cherrywood Shopping Center.

Warm air registers (circled in photo) provide efficient heat distribution in the 25 stores at Cherrywood Shopping Center.

CLEVELAND'S FAMOUS VAN AKEN CENTER, built and owned by Zehman-Wolf Construction Company. Weinberg and Teare, Architects. Says Mr. Milton A. Wolf, Partner—"With over 80% of our 27 stores year 'round conditioned, savings in air conditioning equipment were important. To cut costs, but not performance, we specified Janitrol Duct Furnaces in combination with summer cooling units. We are completely satisfied with our Janitrols. We've had no maintenance problems."

Suspended Duct Heater combined with a summer conditioner at Van Aken Center. Bypass duct cuts off air through furnace during cooling season.

WHAT'S BEHIND JANITROL MULTIPLE FOR SHOPPING

Only a Janitrol Multiple Unit System Provides all these Basic Advantages

SAVE UP TO 50% ON INITIAL COST... Compact, factory-assembled Janitrol heaters install easily—save up to 50% on original equipment and installation cost when used in place of a central system.

UNUSUAL ECONOMY OF OPERATION... Actual cost records from major shopping centers show extraordinary savings in fuel and freedom from maintenance expense.

SAVE INCOME-PRODUCING SPACE... Janitrol units are ceiling mounted, save valuable floor space for sales or service needs.

EXTRA-LONG SERVICE LIFE... Janitrol heaters feature the famous Multi-Thermex Heat Exchanger with the finest performance record in

ARCHITECTS AND ENGINEERS' INFORMATION SERVICE...

Write today for complete A.I.A. files on heating with gas in big buildings of every type, and for Janitrol planning and specifications service. There's no obligation.

MAKERS OF *Surface* INDUSTRIAL FURNACES, *Kathabar* HUMIDITY CONDITIONING, *Janitrol* COMMERCIAL, INDUSTRIAL AND RESIDENTIAL HEATING AND COOLING EQUIPMENT.

THE TREND TO HEATING UNITS CENTERS?

the industry—less than ¼ of 1% heat exchanger tube failures in over a million tubes since 1940!

SUMMER COOLING EASILY ADDED... Cooling coils are easily added in the same ductwork used for heating. A bypass arrangement cuts off air flow through heater during cooling season.

INDIVIDUAL STORE CONTROL... Tenants control heating to suit individual needs. The building owner is relieved of responsibility for operating costs, maintenance, service.

VERSATILE "DUAL FUEL" PERFORMANCE... Janitrol heaters use any type gas, including LP; may be switched from one type to another automatically.

Janitrol field representatives are trained in heating layouts and proper installation methods to assure all the benefits and economies of gas—the clean modern fuel, in an efficient multiple-unit system. They will gladly consult with you on your heating problems.

Janitrol
GAS-FIRED UNIT HEATERS

Janitrol Heating & Air Conditioning Division
Surface Combustion Corporation
Columbus 16, Ohio

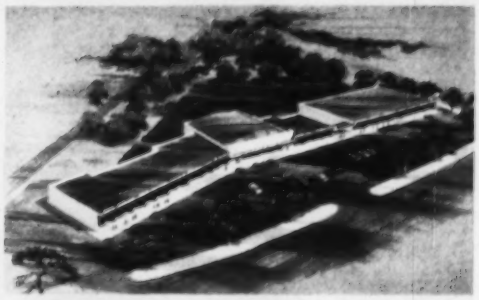
In Canada: Moffat Heating and Air Conditioning Division,
Moffats, Ltd., Toronto 15.

68 JANITROL UNIT HEATERS AT EASTGATE SHOPPING CENTER, AKRON, provide clean, economical gas heating with minimum maintenance expense, use absolutely no floor space! The versatility of Janitrol gas-fired heaters makes them easily adaptable for a wide variety of installations. Choice of input capacities from 50,000 to 1,750,000 Btu/hr.

At Eastgate's 13 stores, Janitrol unit heaters
- ... direct heat where most needed
- ... operate only when needed
- ... save valuable floor space

AT LEVITTOWN'S GATEWAY SHOPPING CENTER, all tenants control their own heating to suit operating hours and individual needs, and the building owner is relieved of responsibility and expense for operation. This convenience for tenants and freedom from furnace financing for the owner is made possible by compact, efficient Janitrol gas-fired unit heaters in place of a central system.

Typical installations of Janitrol gas-fired unit heaters in stores at Levittown's Gateway Shopping Center. Heating-Plumbing Contractors, Latisch and Launer, Brooklyn, N.Y.



NEW DOUGLASTON SHOPPING CENTER, QUEENS, N.Y.

(Architect's sketch.) One of 17 Centers developed by Architect Herbert Tannenbaum, New York City, who says—"I feel it is my responsibility to specify more than just a heating system. I demand proved performance, so I have standardized on Janitrol gas-fired heating. I know, from over a decade of experience, of Janitrol's good record for low maintenance and service costs.

Janitrol Duct Heater installation in Safeway Store at Douglaston Shopping Center.

the New "66 TOTE TRAY" for nipples saves you time on-the-job

● Now you can buy popular size ½" or ¾" black or galvanized nipples in the handy TOTE TRAY shown here. This rugged, easy-to-carry tray eliminates wasted steps on the job. No more pawing search—the right nipple is always ready at hand—in its own clearly marked space. Convenient measuring guide gives instant length verification for each of the 66 nipples in eleven lengths ranging from Close to 6".

Tray is of sturdy, double corrugated board construction. There are no staples to catch or scratch your hands. Finish is attractive silver grain. Each tray is individually packed in and protected by sturdy shipping cover.

For your protection all U-brand nipples are made from new, mill-tested pipe. Special attention is given to true thread gauge, inside ream and outside chamfer. After machining, nipples are thoroughly cleaned and rust protected. In regular carton packaging U-brand nipples are available in ⅛" to 2" diameters in lengths up to 6". Larger nipples up to 4" diameter in any length are available in bulk.

A SINGLE SOURCE FOR ALL YOUR PIPE FITTING NEEDS

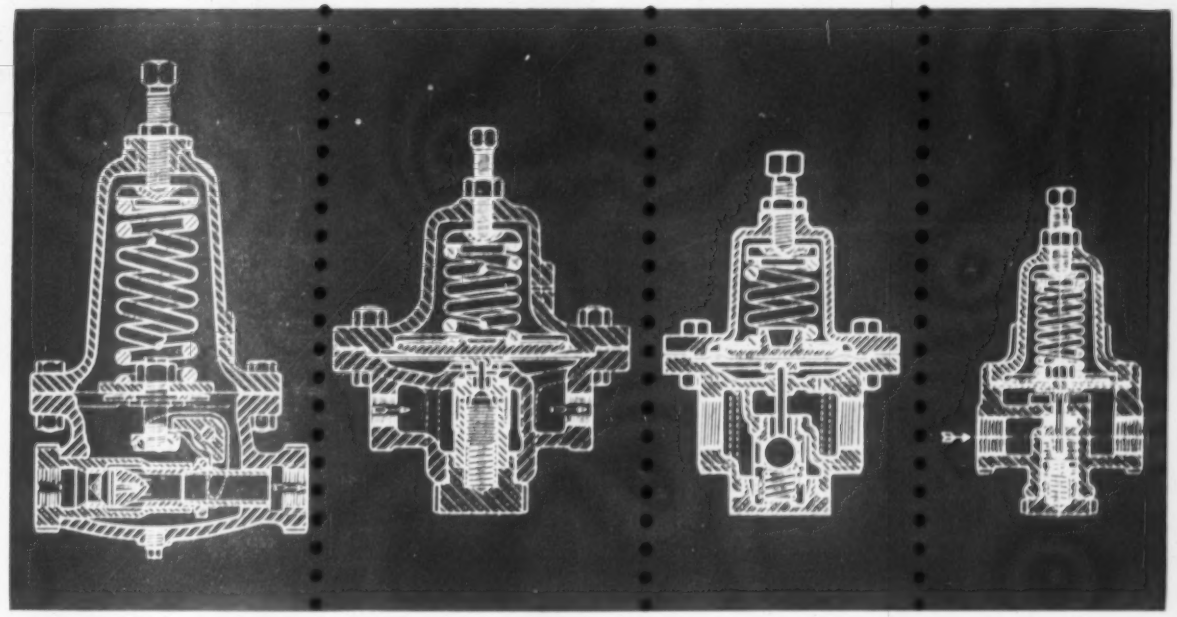
Galvanized and Black U-Cote Malleable Iron Pipe Fittings—Unions—Plugs and Bushings—Cast Iron Drainage and Screwed Fittings—Steel Nipples and Couplings—Insert Fittings for Plastic Pipe.

The Union Malleable Manufacturing Company
Ashland, Ohio

What's your pressure problem?

CASH STANDARD

has the answer... *or will find one!*



HERE ARE FOUR TYPES FOR MANY APPLICATIONS

TYPE 1000 — A streamlined, high capacity valve for close pressure regulation — accurate even under toughest working conditions. Closes against the flow, eliminating conditions that cause chatter. Sizes: ¼" to 2", screwed ends. Bulletin 962.

TYPE D — A general purpose regulator with exceptional regulation characteristics. Now improved to permit easier servicing but basically the same dependable valve offered for over 35 years. Sizes: ¼" to 2". Bulletin 950.

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TYPE 3381 — A small, compact, all-bronze pressure regulator, very accurate and dependable. Available with pressure gauge mounted in one of the two outlet connections. For small lines. Sizes: ¼" and ⅜", screwed ends. Bulletin 948.

There's a Cash Standard regulator for every pressure control problem!

For an individual solution to your control problem, contact the Cash Standard control specialist in your area, or write Dept. B.

CASH CS STANDARD

A. W. CASH COMPANY, P. O. Box 551, Decatur, Illinois

Pressure, Hydraulic, Temperature, Process and Combustion Controls

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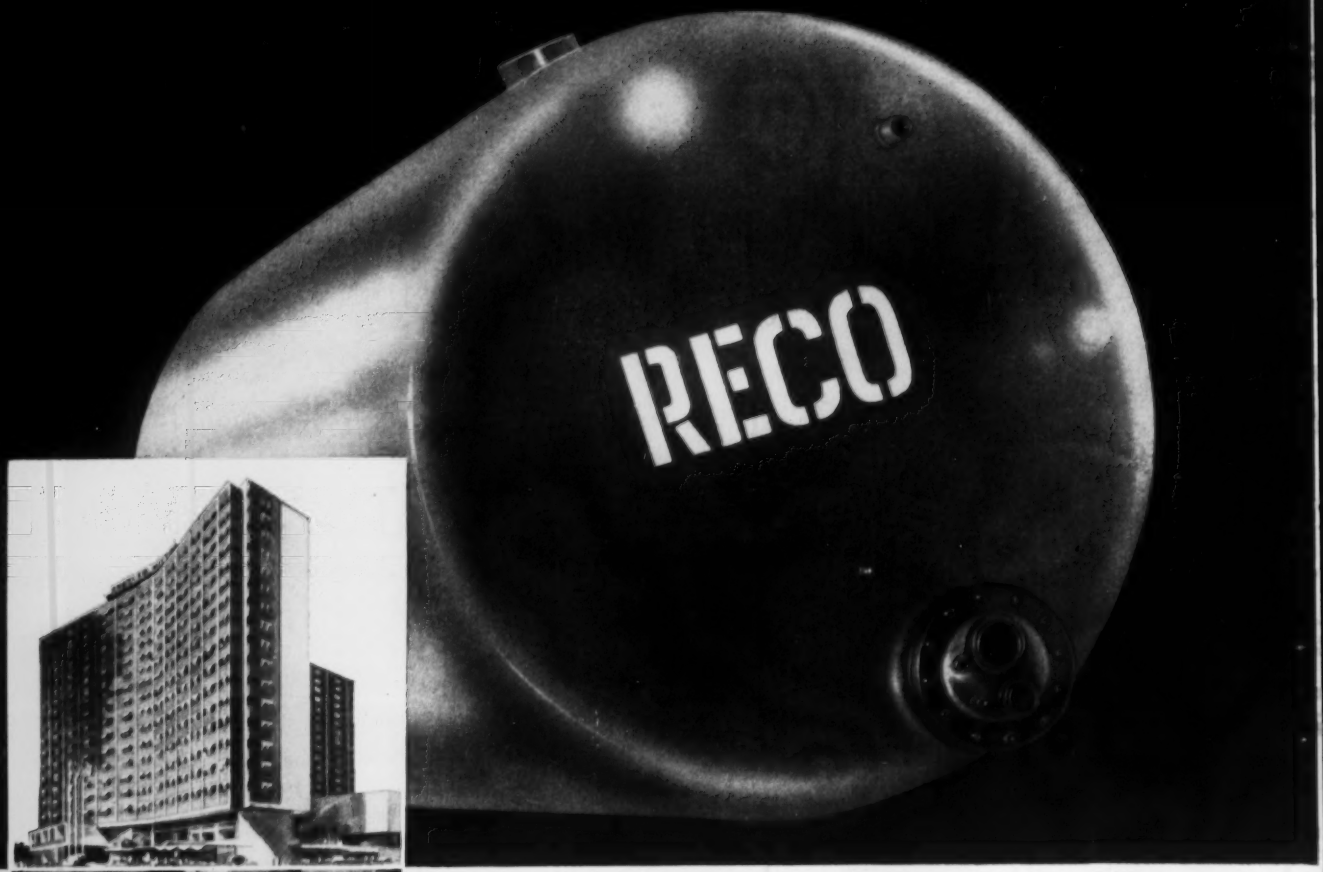

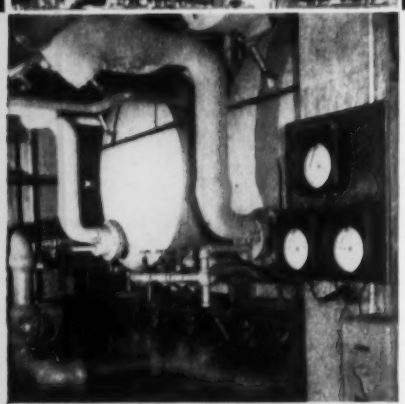

Statler-Hilton Hotel—Dallas, Texas
Architect—William B. Tabler, N. Y.
Engineers—Jaros, Baum and Bolles, N. Y.
General Contractor
Robert E. McKee, Inc., Dallas
Plumbing Contractor—J. S. Brown
E. F. Olds Plumbing & Heating Corp., Dallas

ROOM SERVICE BY **RECO** AT DALLAS' STATLER-HILTON!

Hot water for 1001 rooms! Statler-Hilton knew such service would take some doing. RECO was picked for the job.

Two 84"x168" RECO copper-lined storage heaters keep a 10,000 gallon supply of rust-free hot water ready for room service—24 hours a day.

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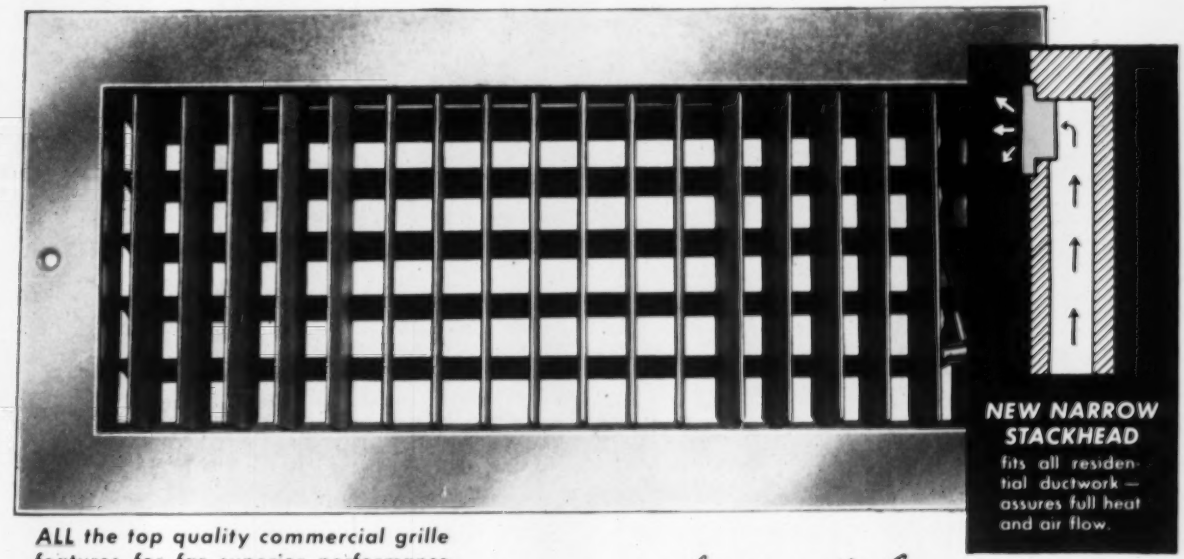
FOR THE FIRST TIME!

A Professionally Engineered Register for Residential Use



ALL the top quality commercial grille features for far superior performance AT NO EXTRA COST!

NEW GREATER ADJUSTABILITY

This Titus Style S-274 multi-shutter register, with individually adjustable louvers—provides air control NEVER BEFORE ACHIEVED in home air distribution. Makes any forced air heating or cooling system perform with superior efficiency. Multi-shutter damper for complete shut-off.

AMAZING NEW SOLID SECTION EXTRUDED ALUMINUM LOUVERS

Solid aluminum, streamlined louvers give super air control. Won't rust—corrode—or freeze up EVER! Quickly, simply, easily adjusted from face of grille—by anyone—for ANY air pattern desired.

NEW EASIER INSTALLATION

Simplest in the world to install. Just 2 easy steps (1) Fasten grille in place with screws (2) Adjust louvers for correct air patterns.

***DON'T* jeopardize the performance of your heating or cooling installations with inflexible stamped registers. *THEY SIMPLY CAN'T BEGIN TO COMPETE!* Underbid your competitors—and at the same time give your customers quality that cannot be duplicated BY SPECIFYING NEW TITUS PROFESSIONALLY ENGINEERED RESIDENTIAL AIR CONDITIONING OUTLETS. Write for complete details now.**

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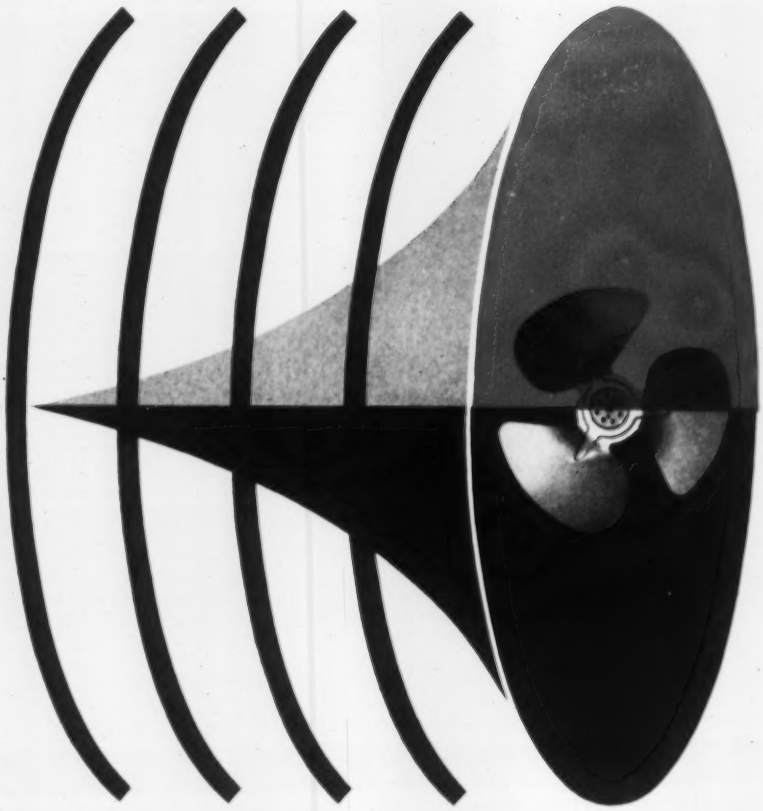
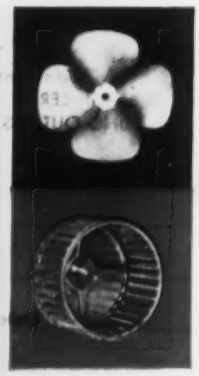
Industry writes the score—to the tune of nearly four billion dollars worth of products a year using Torrington air-impellers.

The research and development necessary to meet this tremendous demand is responsible for upward of half a million design variations of Torrington products . . . nice music when you have a tough problem.

If you are a design or production engineer, our exclusive engineering laboratory facilities—and our product engineering experience—are directly available to you for the solution of air moving problems related to your products.

Simply write or call us, or your nearest Torrington representative.





THE
TORRINGTON
MANUFACTURING COMPANY
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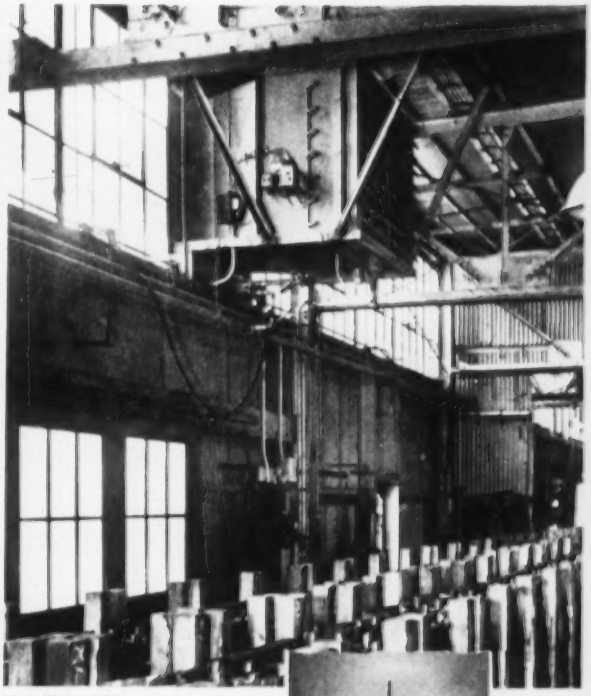
Wing FAS-HCR Heater in factory making asbestos products

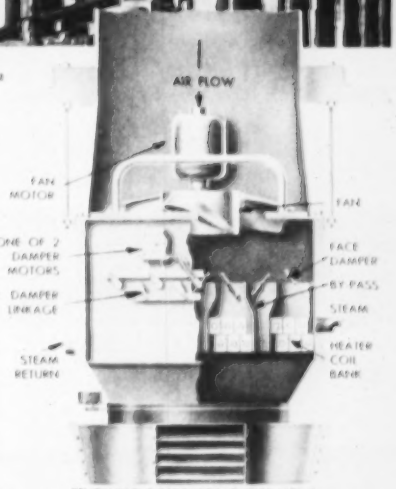


Wing FAS-U Heaters in battery-charging room

When contaminated air is exhausted from your plant, Wing FAS Heaters will replace it with fresh air—automatically heated to pre-determined temperature

Manufacturing processes frequently create heat, fumes, vapors, dust, etc., which must be removed at the source by fans or exhaust systems, and must be replaced, both to permit the exhaust systems to function efficiently, and for the comfort of the workers. For when a building is "starved for air", cold air will rush in through cracks and crevices, trying to eliminate the partial vacuum, and consequently causing much discomfort.

Wing FAS Heaters are designed to deliver to the building an amount of air equal to that which is exhausted, and at just the right temperature. The coils of these heaters cannot freeze, for steam is at full pressure at all times. Temperature is controlled by dampers on heating coils and by-pass passages. Get the complete details in a new bulletin, just off the press.



REVOLVING DISTRIBUTOR OUTLET NO. 5
—OTHER REVOLVING OR STATIONARY DISTRIBUTORS AVAILABLE TO SUIT REQUIREMENTS

Wing

(FRESH AIR SUPPLY)

FAS HEATERS

L. J. Wing Mfg. Co.

140 Vreeland Mills Rd., Linden, N. J.
Factories: Linden, N. J. and Montreal, Canada
In Europe: WANSON, Haren-Nord, Brussels, Belgium

WING REVOLVING HEATERS

WING FANS

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L. J. Wing Mfg. Co.
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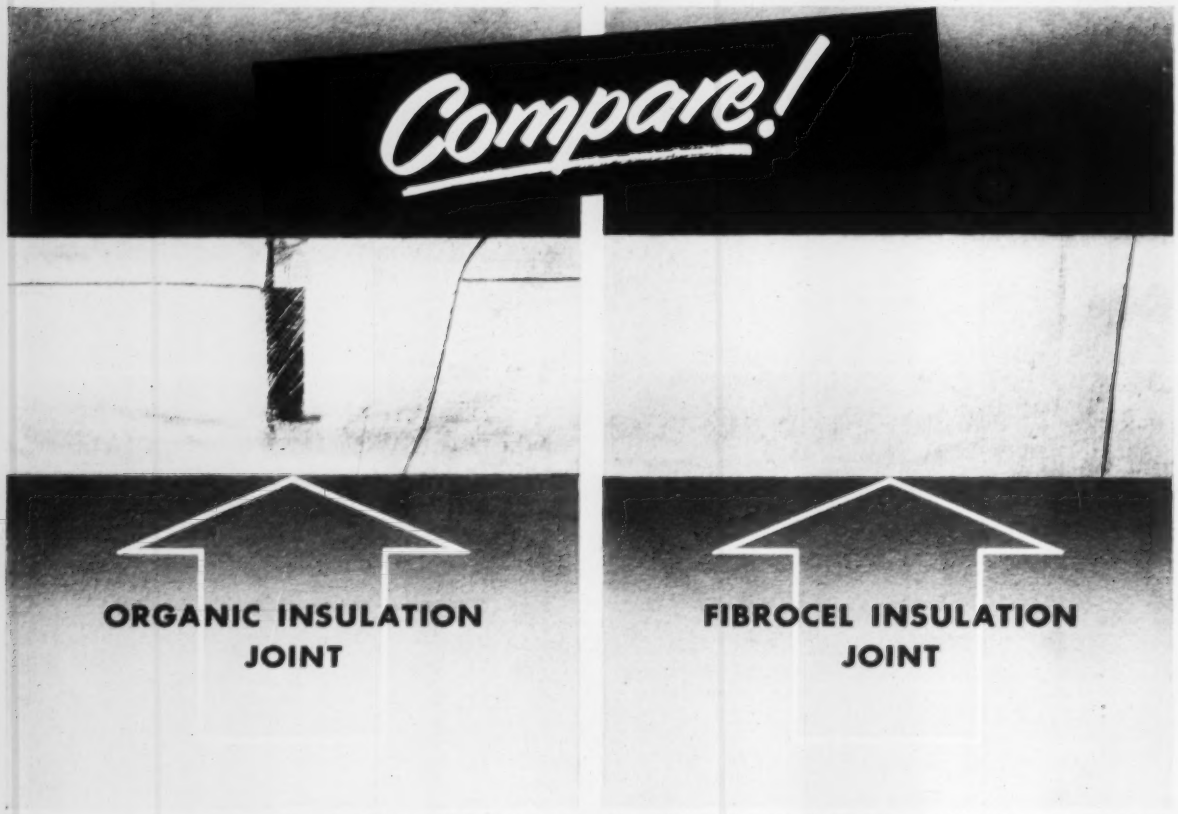

Joints are shown after exposure to high humidity and hot-pipe drying action under identical test conditions.

Shrinkage test proves joints *stay tight* with J-M FIBROCEL Insulation

ONLY FIBROCEL OFFERS ALL THESE ADVANTAGES

No shrinkage—eliminates gaping joints. **Resists compression**—retains full-wall thickness. **Uniform dimensions**—precision formed for exact fit. **Economical application**—lightweight, easy to cut with a knife. **Thermally effective. Permanent**—flame, rot, odor and vermin proof. Developed by Johns-Manville Insulation Research.

A new molded silica insulation developed for plumbing, heating, chilled water and dual service applications in the 35F to 300F temperature range

Fibrocel completely eliminates objectionable shrinkage caused by atmospheric changes!

Tests prove it won't shrink even after moisture exposure and prolonged service under continuous steam flow. This means Fibrocel joints stay tight, with no unsightly gaps . . . messy patching . . . or costly heat loss—ever!

Fibrocel speeds installation, too! It is light in weight and a pleasure to apply. It cuts cleanly, easily with a knife. And its firmness and remarkable dimensional uniformity assure tight, smooth joints . . . and an overall finished appearance that's as neat, round, and true as the pipe itself.

For complete information on Fibrocel—get your free copy of the new 8-page folder, IN-155A. It includes physical properties, insulating characteristics, sizes and thicknesses available. Why not send for it today. Address Johns-Manville, Box 60, New York 16, New York. (In Canada, Port Credit, Ontario.)

Johns-Manville *first-in* **INSULATION**

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The Proved metal for roofing and construction

Install with confidence!
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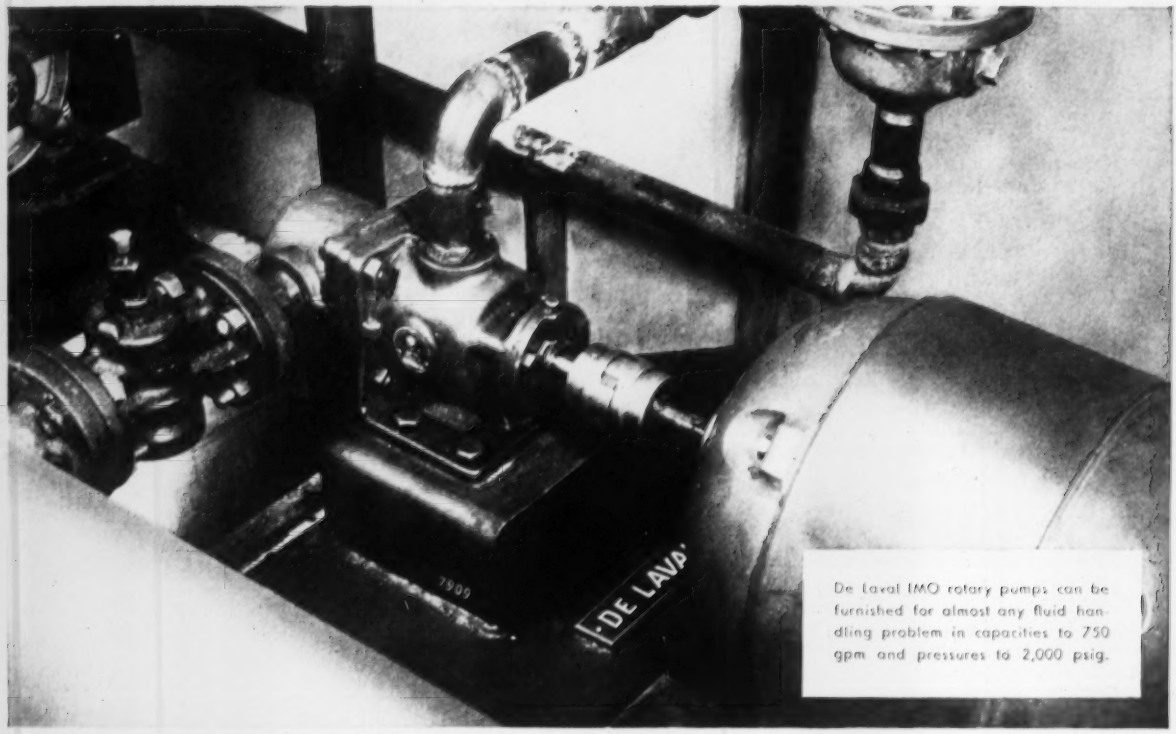


De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 2,000 psig.

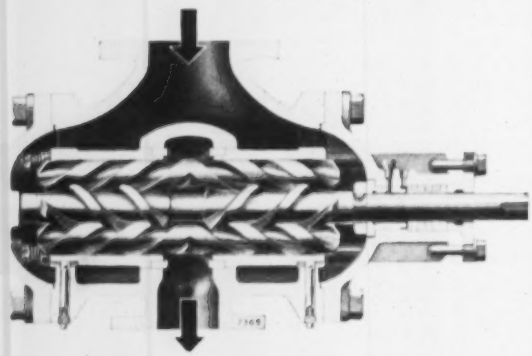
What to Look for in a Rotary Screw Type Pump

By W. J. MONCON, *Assistant Chief Engineer*
De Laval Steam Turbine Company

A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.



This is a cross-section of the De Laval IMO Series A322A, a positive displacement rotary screw type pump.

One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.

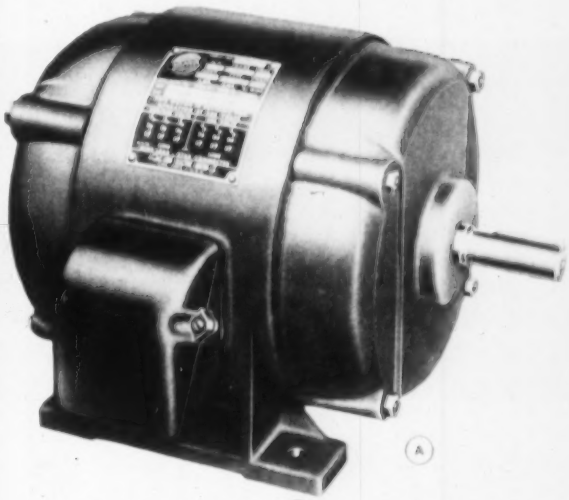
Catalog LS gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application*, contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 871 Nottingham Way, Trenton 2, New Jersey. DL-201

WHATEVER YOUR MOTOR REQUIREMENTS

FOR *Original* **EQUIPMENT..**

THERE'S A

LIMA



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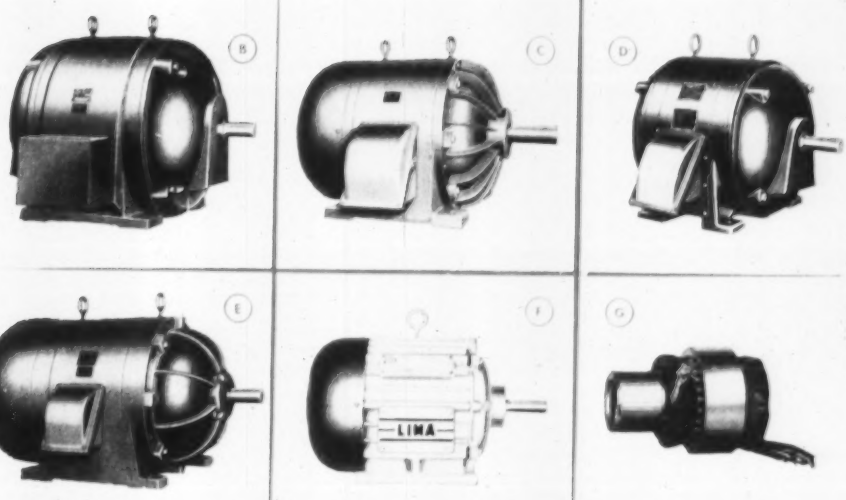
Built-in Dependability
Fast Delivery and Efficient Service



A Lima Type AC, semi-enclosed, drip-proof, Lima Type BC, totally enclosed, non-ventilated, NEMA frame sizes 56 to 254, non-frame mounted.

B Lima Type AC, semi-enclosed, drip-proof, NEMA frame sizes 324 to 365.

C Lima Type BC, totally enclosed, fan-cooled, NEMA frame sizes 324 to 365.

D Lima Type AC, semi-enclosed, drip-proof, NEMA frame sizes 284 to 326.

E Lima Type BC, totally enclosed, fan-cooled, NEMA frame sizes 284 to 445.

F Lima Type C, totally enclosed, fan-cooled, NEMA frame sizes 284 to 326.

Lima Type EB, totally enclosed, fan-cooled, dust tight, U.L. Approved, Class 2, Groups F & G, NEMA frame sizes 224 to 326.

Lima Type EB, totally enclosed, fan-cooled, explosion-proof, U.L. Approved, Class 1, Group D, NEMA frame sizes 224 to 326.

G Lima Shell-type motors and complete special motors, made to order.

$\frac{1}{3}$ to 150 Horsepower

For complete information... See your local Lima Representative listed in Thomas' Register, MacRae's Blue Book, Canadian Mast Purchasing Directory, or write—

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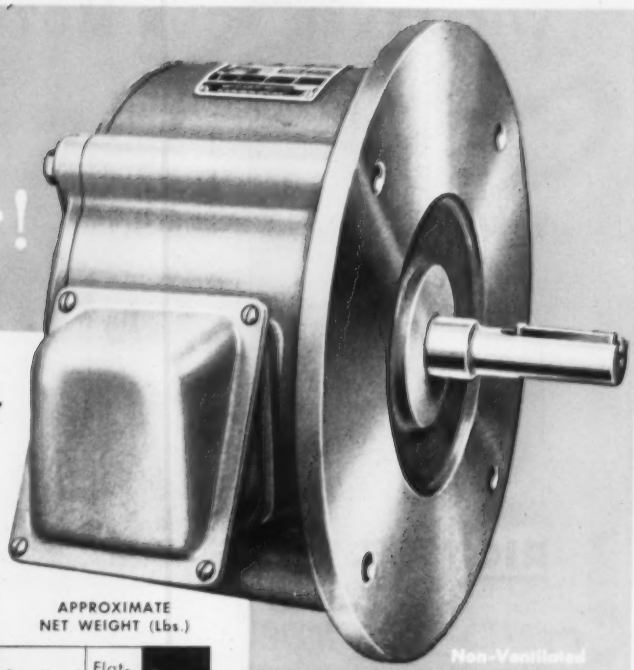
FIRST... FOR MOTORS... DRIVES... SPEED REDUCERS

The Motor you asked for!



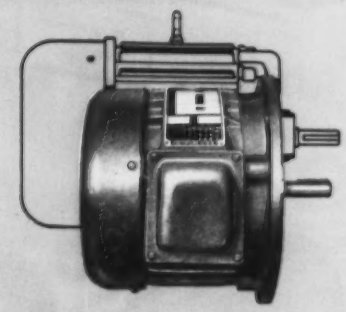
Non-Ventilated

TAKES less space . . . because it's the new FLAT-Type Motor

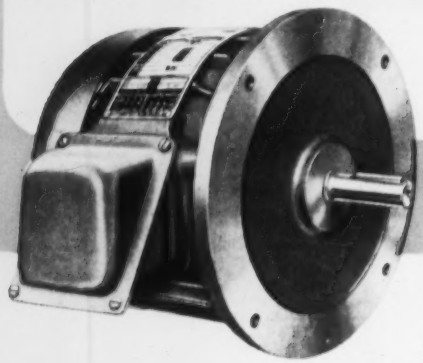
GIVES more service . . . because it's a DIEHL

FOR SIZE AND WEIGHT, COMPARE THE NEW FLAT-TYPE WITH STANDARD MOTORS

FRAME SIZE		OVERALL LENGTH (Inches)			APPROXIMATE NET WEIGHT (Lbs.)		
Standard	Flat-Type	Standard	Flat-Type	Saving	Standard	Flat-Type	Saving
DIF 182	DIF 180	14 1/16	10 3/4	3 3/16	82	59	23
DIF 213	DIF 220	17 3/16	11 9/16	5 5/8	128	83	45
DIF 284U	DIF 280	26	13 13/16	12 3/16	272	135	137



New Flat-Type superimposed on standard motor



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The unique and perfect answer in *integral motors*—designed especially for the machine tool and equipment industries. Packs full horsepower in less space . . . actually up to 48% shorter than standard motors without sacrifice in performance. Many pounds lighter, too, than conventional motors (over 50% in some cases), meaning vastly reduced over-hung weight. Standard radial construction, easy to disassemble and reassemble . . . no precision alignments or complicated air-gap adjustments to contend with. Totally-enclosed . . . no dirt, dust or moisture can get in. Available (non-ventilated) in ratings to 3 H.P., and (fan-cooled) in ratings to 20 H.P.

Perhaps the Diehl Flat-Type Motor is just what you need to solve your application problems. Give us the details and we'll be glad to submit recommendations. Ask for your copy of Bulletin HP-3461.

Diehl

DIEHL MANUFACTURING COMPANY

Electrical Division of THE SINGER MANUFACTURING COMPANY

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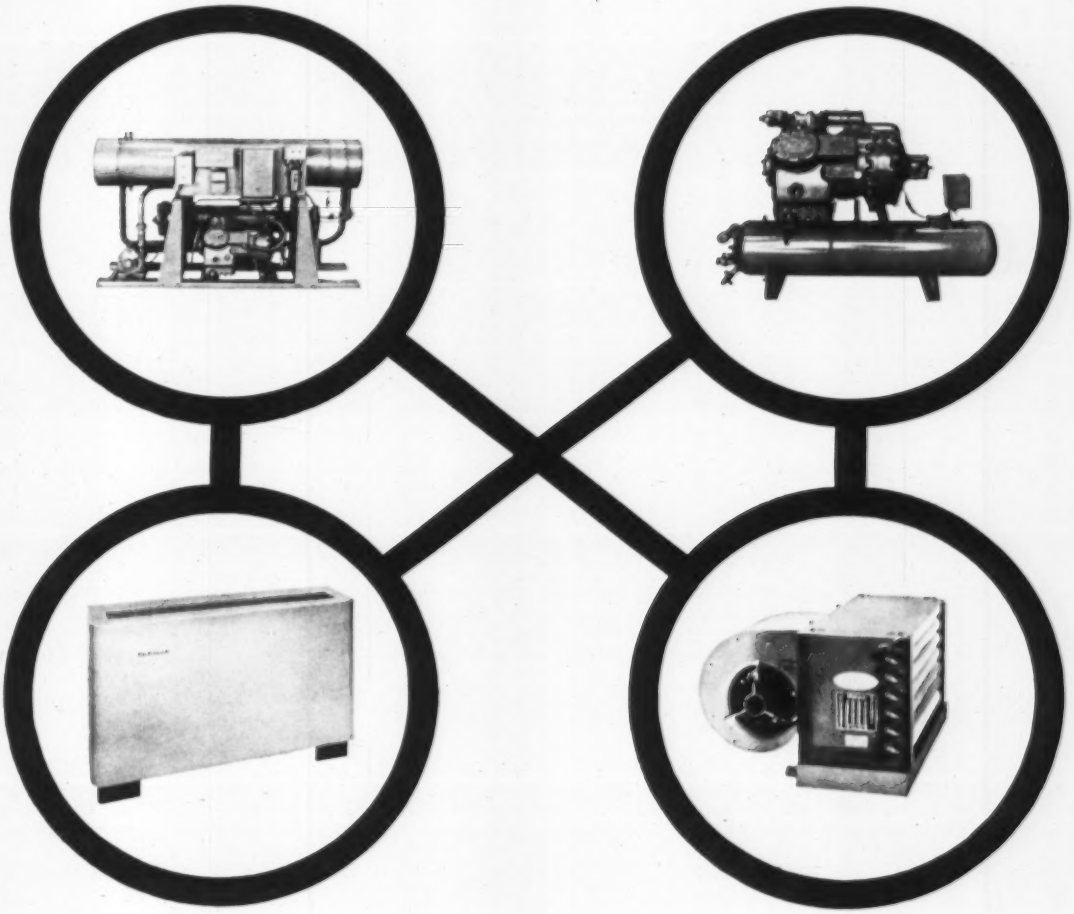
4 NEW WAYS TO AIR CONDITION

Latest Carrier equipment opens up new design possibilities for fan-coil systems in new and existing multi-room buildings

Carrier's new Water Cooling Machines are complete refrigeration packages. Can supply chilled water for cooling to new Weathermakers shown below. Or they can be used for process cooling. Evaporative condenser models: 3 to 60 hp. Water-cooled models: 3 to 200 hp.

Carrier's new Hermetic Condensing Units are designed for air conditioning or commercial refrigeration systems. Can provide direct expansion cooling for Weathermakers shown below. Water-cooled models: 2 to 10 hp. Air-cooled models: 2 and 3 hp.



New Room Weathermakers* provide individual room control of heating and cooling. Designed for direct expansion or chilled and hot water systems. Can be installed horizontally or vertically, with or without cabinet. These fan-coil units are available in ½, 1, and 1½ ton sizes.

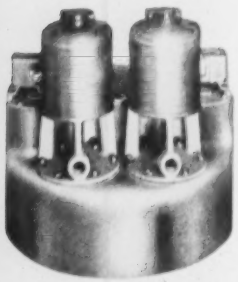
New Unit Weathermakers* are low-cost fan-coil units designed for overhead installation. Individual control of heating and cooling makes these units ideal for multi-room buildings. For direct expansion or chilled and hot water systems. In ½, ¾ and 1 ton sizes.

*Reg. U.S. Pat. Off.

first name in air conditioning Carrier

For further information and literature, call your Carrier dealer listed in the Classified Telephone Directory. Or write Carrier Corporation, Syracuse, N. Y.

Get the most from your pump investment



TYPE CVS—duplex unit
TWO FLOAT SWITCHES

Recommended for heavy duty service. Separate control mechanism for each pump motor—or one float which controls automatic alternator.

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There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

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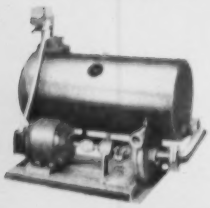

TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

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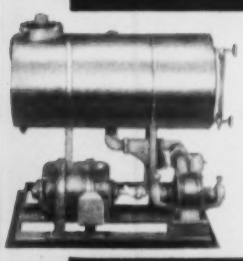


TYPE TM

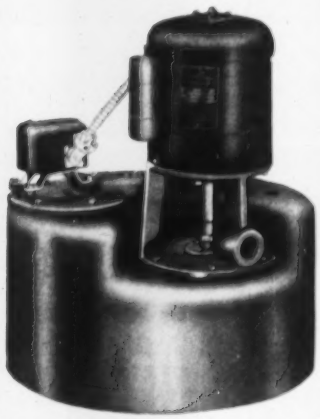
Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

Write for *Bulletin No. 17*

THE SKIDMORE CVS SETS THE PACE IN PUMP PERFORMANCE!

Send for the NEW Bulletin

The CVS vertical pump offers more for your money—mechanical shaft seal—greater range of discharge pressures—still retains compact design and light weight.



TYPE CVS—SINGLE UNIT

Representatives in principal cities.

Skidmore Pumps have set a Standard of performance and dependability since 1921.

SKIDMORE PUMPS

SKIDMORE CORPORATION
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ACCURATE IN SIZE AND TOPS IN QUALITY!

Chase® Type L Copper Tube!

It's a sure thing! Your heating, air conditioning and refrigeration equipment will deliver dependable, *peak performance over the years*, when you fabricate with Chase Type L copper tube!

Inside and out-side diameters accurate to thousandths of an inch assure proper tolerances for fitting connections. That means extra-easy assembly of finned sections. Smooth interiors of tube and Chase solder-joint fittings insure a steady, even flow of heating or cooling liquids. And for extra cleanliness, you can get Chase Type L copper tube tightly capped at slight extra cost.

Order Chase Type L copper tube, Chase extra-soft copper refrigeration tube and Chase wrought copper solder-joint fittings from the Chase wholesaler near you!

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Beth-Co-Weld Pipe is used for heating lines in R. H. Macy and Co. suburban store, White Plains, N. Y. Contractor: Wolff & Munier, New York. Jobber: Chas. F. Guyon, Inc., New York.

These Recently Completed Buildings Use Beth-Co-Weld Steel Pipe

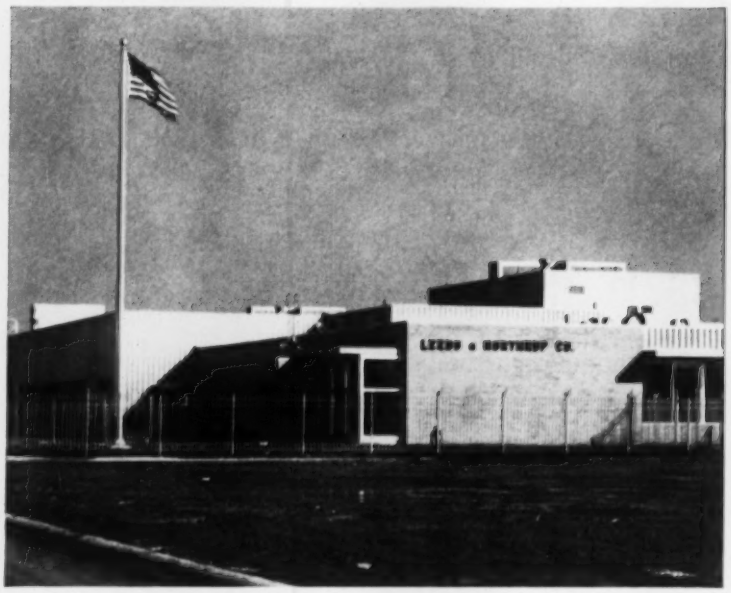
These two new structures, one a store at White Plains, N. Y., the other a factory building at North Wales, Pa., have one thing in common—a network of Beth-Co-Weld steel pipe.

For virtually any type of construction you can name, Beth-Co-Weld is a wise choice for general-purpose piping. This is because Beth-Co-Weld is a quality product, manufactured from sound steel by the continuous-weld process. It is economical pipe, in the shop and out on the job, because it's so easy to work.

Beth-Co-Weld is made in sizes from ½ in. to 3 in., standard-weight and extra-strong weight, and in 21-ft lengths, plus or minus 1 in. It is also produced in 3½-in. and 4-in. sizes, in standard-weight only.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



About 70 tons of Beth-Co-Weld are used in this new plant of Leeds & Northrup Co., North Wales, Pa. General Contractor: H. E. Baton, Philadelphia. Mechanical Contractor: Riggs Distler & Co., Inc., Baltimore. Jobber: B. H. Deacon Company, Inc., Philadelphia.

BETHLEHEM STEEL

BETHLEHEM STEEL

Now Achieved! Maximum Protection *plus* Effective Insulation for Underground Steam and High Pressure Hot Water Distribution Systems and -- *at a new low cost!*

MIRACLE *insul-fil*

CONDUIT SYSTEM combines a uniform refined heat stable bituminous material with a precoated expanded Perlite. The components and the finished product are produced by controlled manufacturing procedures.

INSUL-FIL easy to use. Simply pour directly from bag into trench.

After many months' exposure, note how tightly Insul-Fil clings to entire surface of pipe.

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The initial heat from high pressure hot water or steam distribution systems converts the INSUL-FIL to a thermo-plastic, water resistant and highly efficient insulating and corrosion resistant conduit. INSUL-FIL does not crack on cooling. The INSUL-FIL Conduit System possesses exceptional structural strength and flexibility, at high and low temperatures.

Now specify and use the INSUL-FIL Conduit System for all of your underground steam distribution lines.

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Revolutionary new flexible tubing and duct insulation for air conditioning equipment and systems, and industrial installations — interior and exterior. Combines highly efficient Fiberglas® insulation with plastic vapor barrier jacket. Slips on over tubing, locks in place with entirely new FlexiGrip zip-on closure. Sizes for all applications.

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YOURS ON REQUEST: Insul-Fil Technical Bulletin, complete with photographs, details, and specifications. Write for your free copy today.

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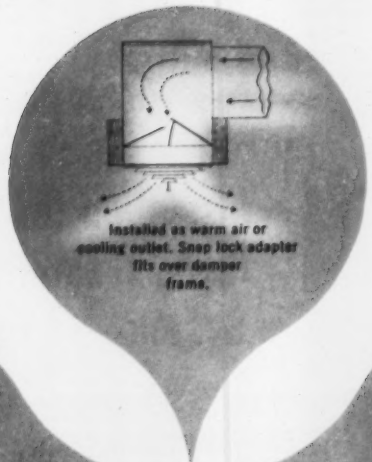
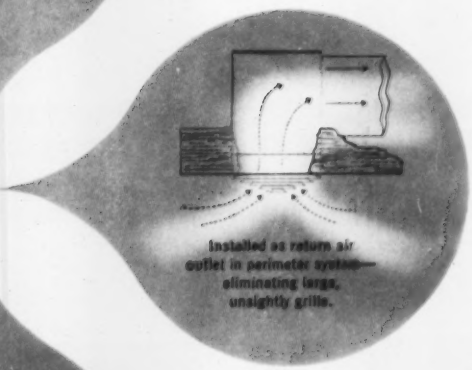
Finishing touch to today's ceiling

Lima series 60 square design ceiling diffuser





accentuates the beautiful symmetry of modern ceilings

When the specs call for a ceiling diffuser, you'll make your customer happier—and your job easier—by installing the Lima square design ceiling diffuser. It harmonizes beautifully with today's acoustical tile or block ceilings, and modern rectangular rooms. Light beige Lima finish is permanent and requires no repainting.

assures complete comfort in heating and cooling

The Lima-engineered square design and tiers of step-down vanes provide greater free area for more effective air diffusion in all directions at correct angles for complete indoor comfort—in heating and cooling. *Ask your jobber's salesman or write direct for new complete Lima catalog.*

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LIMA, OHIO

Sold exclusively through heating wholesalers and manufacturers

Sunray Building, Tulsa, Oklahoma. Architect: Hugh R. Humphreys; Consulting Engineers: Carnahan and Thompson; General Contractor: Manhattan Construction Co.; Equipment Contractor: Carl Moore Co.

D. C. Kennedy (left), special-service director of Sunray Mid-Continent Oil Co., and H. E. Kenslow, vice president of Anderson-Rooney Operating Co., which owns and operates Sunray Building

In Tulsa, weather news is made indoors!

The modern Sunray Building presents over 28,000 square feet of glass area to Tulsa, Oklahoma's blazing 100° summer heat and its frigid, below-zero winter climate.

To combat these unusual temperature changes, Anderson-Rooney selected American Blower air conditioning equipment. Result: ideal indoor comfort the year round, regardless of weather outdoors.

"Our American Blower equipment has been running continuously," says Building Engineer W. B. Reed, Jr. "Not once has it failed us in any manner. In fact, it has practically taken care of itself. We have exercised no maintenance, no repairs. About the only thing that we've done is to wipe the units down occasionally to keep them clean."

If *your* plans include air conditioning, it will pay you to talk to an American Blower sales engineer. He's backed by a full line of equipment for any size or type of installation. Call our nearest branch, or write us direct.

In addition to equipment for complete central systems, American Blower offers packaged air conditioners for offices, stores, small industrial plants, similar applications.

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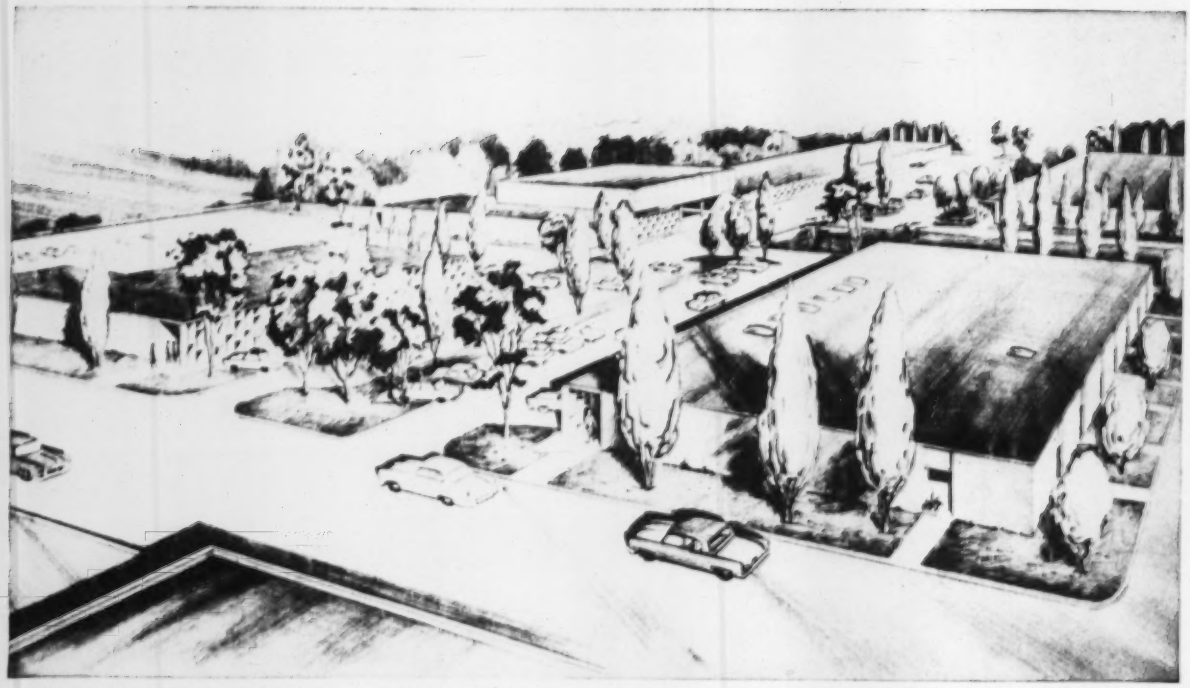
AMERICAN BLOWER

Air conditioning equipment for every business



Dallas' new Decorative Center. Owner: Mr. Trammell Crow. Architect: Mr. Jacob Anderson. Builders and General Contractors: McFadden & Miller. G-E Distributor: Texas Distributors, Inc.

NEW DECORATIVE CENTER IN DALLAS SELECTS G-E packaged AIR CONDITIONERS

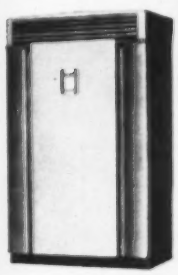
New proof that the merchandising-minded look to General Electric for the best in air conditioning! Now, it's the Decorative Center in Dallas, Texas—one of that progressive city's most important new business additions.

Designed and built to reflect the increasing significance of Dallas in American commercial life, this new center is "comfort serviced" by 22 G-E Packaged Air Conditioners, in various sizes amounting to 130 tons. In making the installation, Texas Distributors, Inc., General Electric distributors in Dallas, located units to give each tenant individual control of temperature and humidity. Total area serviced: 56,000 square feet.

An especially important feature of the G-E installation is its flexibility in meeting future air conditioning needs. The center has been planned to accommodate up to 100,000 more square feet, in which additional air conditioning units can be placed without any rearrangement of existing equipment.

Low-cost, dependable G-E Packaged Units provide maximum design freedom in new construction and modernization. All models may be used singly or in multiple to meet any air conditioning need. General Electric's famous 5-year warranty assures protection against service problems. For complete details, write: General Electric Co., Commercial & Industrial Air Conditioning Dept., Bloomfield, N. J.

Self-contained ceiling models
3 and 5 ton air-cooled
3, 5 and 7½ ton water-cooled.



Self-contained floor models—3, 5, 7½, 10 and 15 ton water-cooled.

packaged AIR CONDITIONERS

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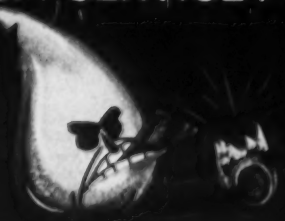
MOISTURE

Dramatized Story of the Cause and Cure
of REFRIGERATION'S No. 1 SERVICE PROBLEM



For You to See and Show

Educational, Entertaining
SOUND-SLIDE FILM

IN FULL NATURAL COLOR

Prepared under the technical direction of DR. WALTER O. WALKER, "Genetron" Consultant and Dean, Division of Research and Industry, University of Miami.

A Full Report Highlighting

- **Sources of moisture in refrigeration systems.**
- **Problems and damage caused by moisture.**
- **Recommended methods for removing moisture.**

Here's information of real practical value to the air conditioning and refrigeration service engineer . . . a sound-slide film prepared by General Chemical to help you handle the problem of moisture in refrigeration systems.

"Moisture" is a swift-paced, 35-minute sound-slide film in full natural color. It is instructive, informative . . . gives authoritative, up-to-the-minute information on every phase of the costly moisture problem.

Full of "how-to-do-it" topics! Covered are: how moisture gets into the refrigeration system and how to keep it out; the problem of "freeze-ups" and its solution; the causes of corrosion; how moisture reacts to form destructive acids and sludges; how insulation breakdown and motor burnouts are related to moisture; sound practices for care in the field; how to purge moisture from the refrigeration system; how to dry out a system with or without an oven; facts about desiccants, etc.

Refrigeration Service Engineers Society Members are invited to show this film at their chapter meetings.

Refrigeration and air conditioning wholesalers, equipment manufacturers, and contractors are invited to make full use of it in briefing their organizations on moisture control, and to show it at meetings for customers. Also available to technical schools and colleges offering refrigeration courses.

FREE! Send coupon for loan of full-color print and record. Free prints also available on long term or permanent basis; write for particulars.

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GENERAL CHEMICAL DIVISION
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☐ If you do not have a sound-slide projector, check here and a General Chemical representative will arrange a showing for you.

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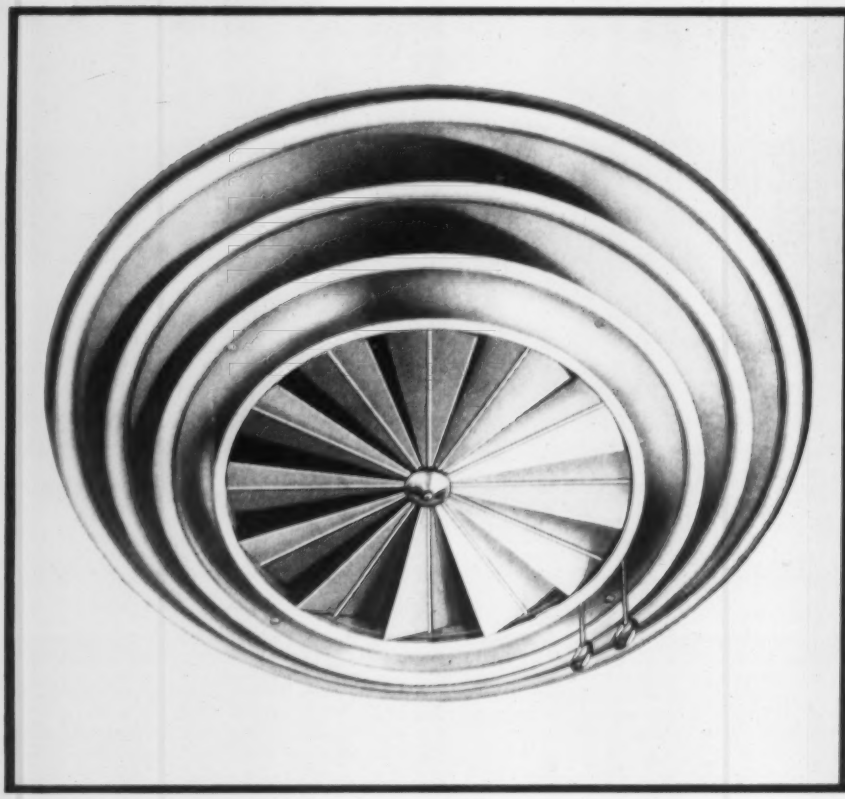
New Venturi-Flo Diffuser for high ceiling applications . . .

. . . complete flexibility for effective air distribution in factories, gymnasiums, auditoriums, garages, churches, lobbies . . . handles heated or chilled air



COMPLETE CONTROL of the vertical air pattern for spot heating, or for heating large areas to meet comfort requirements, is provided by the BP Venturi-Flo Diffuser. Adjustable vanes of the pattern control permit full variation of the air patterns from vertical to horizontal . . . adjustable from the floor or through the duct from the crawl space above the ceiling.

For engineering excellence, from product development to product application, come to . . .

LIKE ALL UNI-FLO EQUIPMENT, this new pioneering development has the rugged construction you can depend on . . . the efficient diffusion which assures owner satisfaction . . . the authoritative performance data you can use with confidence. Get complete specifications from your nearby Field Office, or write us . . . today!

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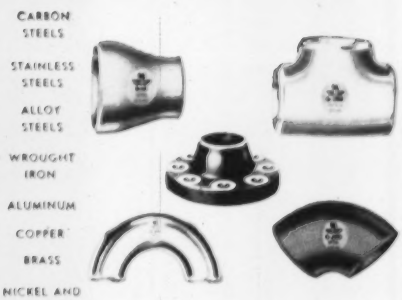
ENGINEERING

You can specify TUBE-TURN Welding Fittings and Flanges and know that you'll get the exact answer to your problem. The line includes all types in all piping materials, schedules and sizes. Also, Tube Turns offers you engineering assistance and helpful design literature.



PURCHASING

Tube Turns offers you outstanding distributor service . . . local stocks, geared for fast service. You can depend on this source for *all* your needs in welding fittings and flanges. One order . . . one source saves purchasing time.

INSTALLATION

Welders are enthusiastic about TUBE-TURN products because they fit up true, and elbows can be cut to odd angles with perfect alignment. Rigid inspection and quality control by Tube Turns assures absolute dimensional accuracy and uniformity.

NEW BOOKLET—This new Tube Turns' booklet gives helpful information on pipe, fitting and flange materials. Mail the coupon for your free copy.

TUBE TURNS, Dept. A-3
224 East Broadway, Louisville 1, Kentucky

Please send free copy of Pipe, Fitting and Flange Materials.

Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

Available from your nearby TUBE TURNS' distributor

DISTRICT OFFICES:

New York	Los Angeles
Philadelphia	San Francisco
Pittsburgh	Seattle
Cleveland	Atlanta
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Chicago	Houston
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Denver	Midland, Texas

*"TUBE-TURN" and "⊞" Reg. U. S. Pat. Off.

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

PLEASE ACCEPT THIS INVITATION!

We have a copy of the Dover Complete Line 12-page catalog waiting for you. It will answer your questions about Dover towers. Just fill in the attached coupon and your free copy will be on its way to you.

DOVER Manufacturing Co. Inc.
Dept. 100 3117 Weatherford Ave.
Independence, Missouri

☐ I would like to have my FREE copy of the Dover Complete Line 12-page Catalog.
☐ Send me the name of my nearest Dover representative.

Name_____
Firm _____
Address_____
City_____ Zone___ State_____

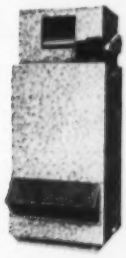
HERE'S THE RIGHT TOWER FOR THE JOB!

DOVER Complete Line of Packaged Cooling Towers

Whatever your cooling tower needs, now there is a Dover packaged cooling tower that's just right for the job. From 2 to 100 tons capacity, the complete line of Dover towers is America's new standard in packaged cooling towers.

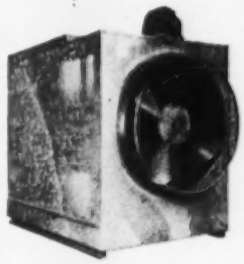
Here is quality at a competitive price! While Dover towers are priced among the lowest in the industry, when you consider all the features you get only in a Dover tower, they are actually less expensive than others.

A TOWER FOR EVERY NEED . . . A NEED FOR EVERY TOWER!



VERTICAL INDUCED DRAFT TOWER
with Centrifugal Blower—Series V

Ideal where space is limited. Install this compact tower anywhere in the building. Piping requirements are at a bare minimum. Super-quiet operation lets you place it in rooms close to workers—and it will ventilate the room that it is in. From 5 to 100 tons.



HORIZONTAL INDUCED DRAFT TOWER
with Propeller Fan—Series CF

A compact unit with all the design and construction features that you have been looking for in a packaged tower. Neat in design, rugged in construction, it is ideally suited for small air conditioning and refrigeration installations and for jacket water or air compressor cooling. From 2 to 100 tons.

NATURAL DRAFT TOWERS
In Steel & Redwood—Series S—or All Steel Construction—Series K

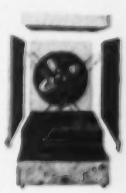
Take your pick from either the new all-steel construction or the somewhat lower-priced redwood and steel construction. Both have the exclusive Dover bolt-free principle for quick, easy installation. Two men can erect some sizes in just 20 minutes. From 3 to 100 tons.

LOOK AT THESE BONUS FEATURES YOU GET ONLY IN DOVER TOWERS!

HOT-DIP GALVANIZING all metal parts on all Dover towers are hot-dip galvanized *after* fabrication. This costs you nothing extra, yet saves you a lot by stopping costly rust and corrosion problems.

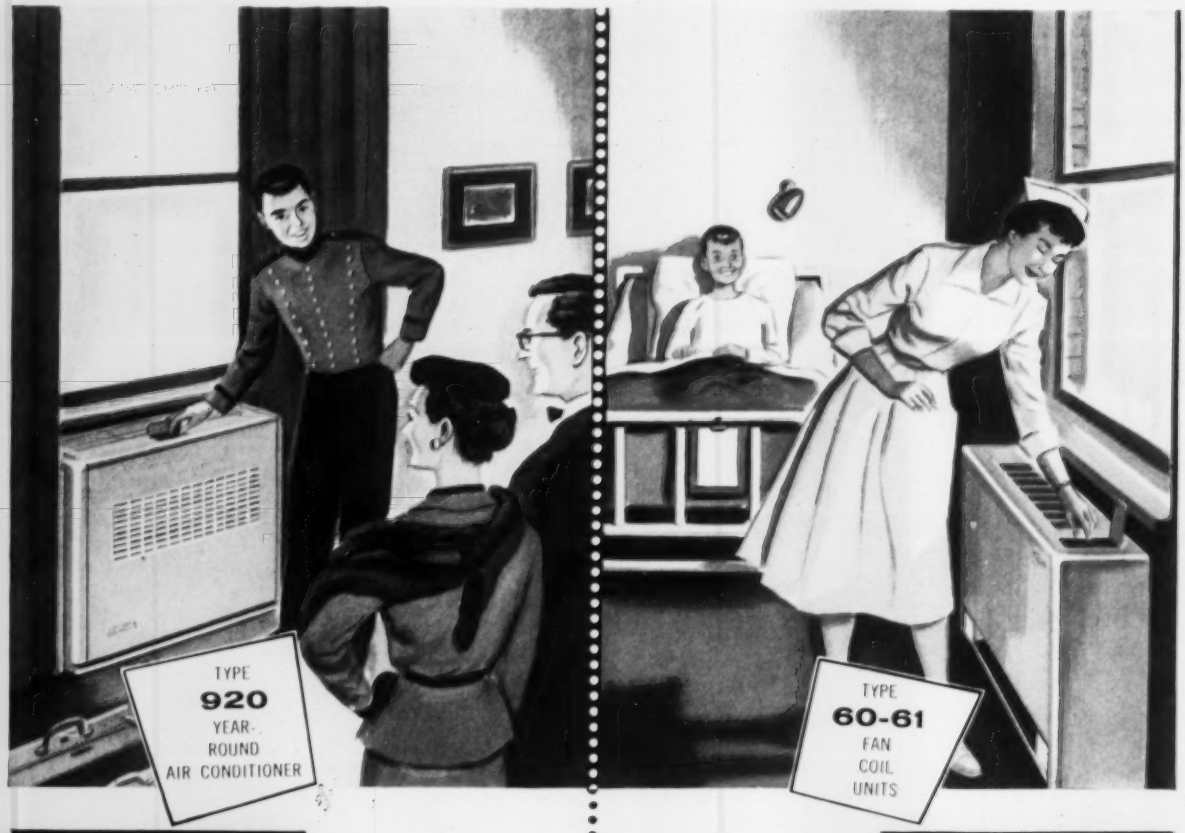
STAINLESS STEEL FANS . . . and shafts are standard equipment on all Dover Series CF towers, providing you with years of trouble-free performance. Built to last.

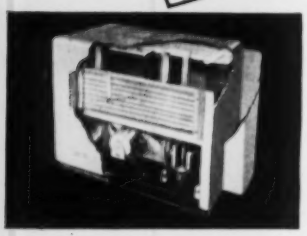
"TAKE-APART" FEATURE is another Dover exclusive! By virtually eliminating bolts, Dover towers can be quickly taken apart and reassembled where basement or rooftop locations make this desirable.



Now—your choice

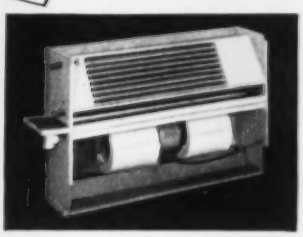
for year-round air conditioning of commercial and institutional buildings—from **MUELLER CLIMATROL**





For
self-contained cooling . . . central steam or water heating

For
central cooling and hot water heating systems



Recessed Air Conditioner. Individual room control saves fuel and power costs — unit works only when needed. You can offer heating *and* cooling for about half the cost of a complete central system. Can be installed room-at-a-time on budgeted program, without disturbing tenants. Efficient one-hp refrigeration cycle uses no water.

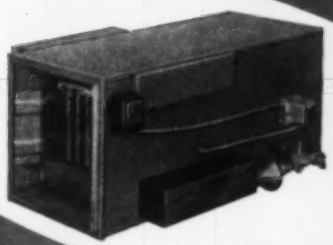
Fan Coil Units. Both recessed and cabinet types, in the most complete range of floor-mounted sizes — 200, 300, 400 and 600 cfm. Twin blowers draw room air through permanent filter (standard), blend it with fresh outside air if desired, force it over coil that circulates hot or chilled water. Four-row coil gives better dehumidification.

With this pair of outstanding units, you've an inside track in your bids for multi-room heating and cooling installations. *For new buildings*, both design and performance stand out as the ultimate in modern comfort concepts.

As replacements, their economy and ease of installation add convincing weight to the magic appeal of all-year air conditioning. For closer study of facts, specifications and installation data write for literature.

Mueller Climatrol
Department 66
2023 W. OKLAHOMA AVE. • MILWAUKEE 15, WIS.

the greatest dollar value ...Utility WEATHERAMIC



HORIZONTAL FORCED AIR FURNACE

Modern forced air heating doesn't have to cost a "modern" price. Utility has engineered its new Weatheramic® line of Horizontal Forced Air Furnaces to fit installations where both dollars and floor space are limited. Color styled in Bank Note Green, these units are compact and easy to install in an attic, under the stairs, or any otherwise unusable space. Quiet, economical operation is assured by Utility's patented 3-speed variable Dy-Rekt® Drive Blower and diaphragm control valves. As with all Weatheramic forced air furnaces and air conditioners, installation costs and problems are reduced by factory pre-wiring and completely assembled manifold. Backed with a written guarantee, you'll have no trouble selling Weatheramic "Horizontals" whenever luxury forced air heating is desired at low cost.

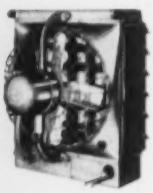
UTILITY APPLIANCE CORP. Manufacturers of Utility Furnaces, Air Coolers, Air Conditioners, Water Heaters and Boilers & Boiler and Combination Gas Ranges

Weatheramic LINE UTILITY

FORCED AIR FURNACES/AIR CONDITIONERS

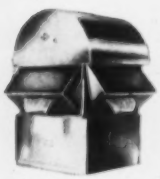
UTILITY APPLIANCE CORP. 4851 south alameda street, los angeles 58, california

ILG Unit Heaters
The complete line—steam, hot water, gas or electric—with capacities ranging from 18,600 to 286,000 BTU.



ILG Centrifugal Fans
Designed for a wide variety of pressure and volume requirements — certified capacities ranging from 374 CFM to 116,400 CFM.

ILG Power Roof Ventilators
Long-lasting, quiet, easy to install, leak-proof—provide efficient ventilation independent of wind and weather.



INSTALL Ilg SELF-COOLED PROPELLER FANS

The secret of ILG's better design is the exclusive *self-cooled* motor! Clean, cool, fresh air is drawn into the motor enclosure through an *outside vent pipe*. The motor stays clean and cools itself — dusty, greasy air can never reach it to interrupt service or shorten its life! ILG self-cooled fans have the lowest operating and maintenance cost of any open type motor combined with a fully enclosed motor . . . a savings up to *10% on power costs alone!*

ILG ELECTRIC VENTILATING CO.
2826 N. Pulaski Road,
Chicago 47, Illinois

ILG
50TH
ANNIVERSARY
1906-1956

YOU'RE PROTECTED 3 WAYS WHEN YOU INSTALL

AMERICAN

VIBRATION ELIMINATORS

Installed clean, bright and dry. The tough, water tight, polyethylene envelope preserves the factory built-in quality. When you're ready to install, the envelope is easy to remove, the Vibration Eliminator comes out bright, clean, and dry. Simplified installation instructions in each box make your job easier.

Lasting, leakproof performance engineered and built-in at the factory. The core is seamless, corrugated tin-bronze tubing, quality controlled through every manufacturing stage. This copper-tin alloy is specially engineered to stand up under vibration while carrying gases and liquids under pressure. Because the core is *seamless*, there are no joints or laps where leaks can start.

For extra strength and durability, the core is covered with bronze wire braid securely brazed in place. Sizes through 2" have a single wire braid covering, larger sizes a double braid covering for added strength.

Before it's shipped, the final assembly is pressure tested, oven dried, and sealed in a plastic envelope to keep out dirt and moisture.

3 **You know what you get** when you insist on "American Vibration Eliminators" marked on the carton and "American" stamped on the ferrule of the assembly. To get quality—look for "American."

American Vibration Eliminators are sold by leading distributors everywhere. For descriptive folder of standard sizes with installation instructions, write to The American Brass Co., American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

FOR AMERICAN VIBRATION ELIMINATORS SEE YOUR

ANACONDA

DISTRIBUTOR

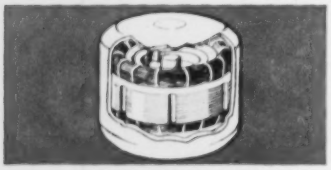
. . . make installation easier, cut costs

Install a blower with a Delco Products direct drive motor on your next blower job. This simplified blower design with fewer moving parts makes possible a more compact, lighter weight installation requiring less maintenance. Best of all, it costs less.

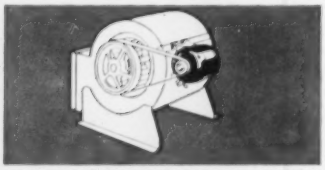
You can get direct drive blowers equipped with four different basic types of Delco Products motors: shaded pole, extended winding, permanent split-capacitor, and split-phase. In this wide selection of designs and models there is a motor to meet every application and power requirement.

Every blower powered by a Delco Products direct drive blower motor has been carefully engineered by both Delco Products and the blower manufacturer to give long life and economical operation. Delco Products maintains service stations from coast to coast and throughout the world for quick, competent, reliable service.

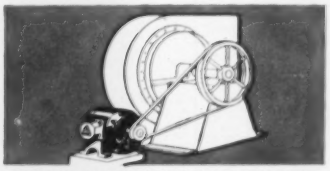
For assistance on any motor problem, contact your nearby Delco Products Sales Office or Delco Products, Dayton, Ohio.



DELCO PRODUCTS HERMETIC MOTORS for refrigeration compressors. Four-pole models, 1 12 to 10 h.p. Two-pole models, 1 8 through 15 h.p.



DELCO PRODUCTS BELT DRIVE MOTORS. Split-phase, capacitor-start, and polyphase fhp models for fans, blowers and compressors.



DELCO PRODUCTS POLYPHASE INTEGRAL HP MOTORS in rerated NEMA frames now provide more power per pound.

GM GENERAL MOTORS DELCO DAYTON OHIO

DELCO *Electric* MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS, DAYTON, OHIO

Proved best by Performance!

ONE OF THE GARLOCK 2,000

"KING-SIZE" FOR KINGSTON

GARLOCK RUBBER EXPANSION JOINTS

At the TVA's Kingston Steam Plant (the world's largest) the total capacity is 1,600,000 Kilowatts, made up by four 150,000 KW steam turbogenerators and five 200,000 KW turbogenerators.

80,000 sq. foot condensers, drawing 65,000 gpm. of cooling water, are spring mounted on the exhausts of the 200,000 KW turbines. 60" dia. Garlock Rubber Expansion Joints installed between condenser water inlet and concrete imbedded water piping, compensate for misalignment and provide for expansion and contraction.

These "King-Size" Rubber Expansion Joints are only part of "the famous Garlock 2,000"... two thousand different styles of gaskets, packings, and seals to meet *all* your needs... the *only* complete line available.

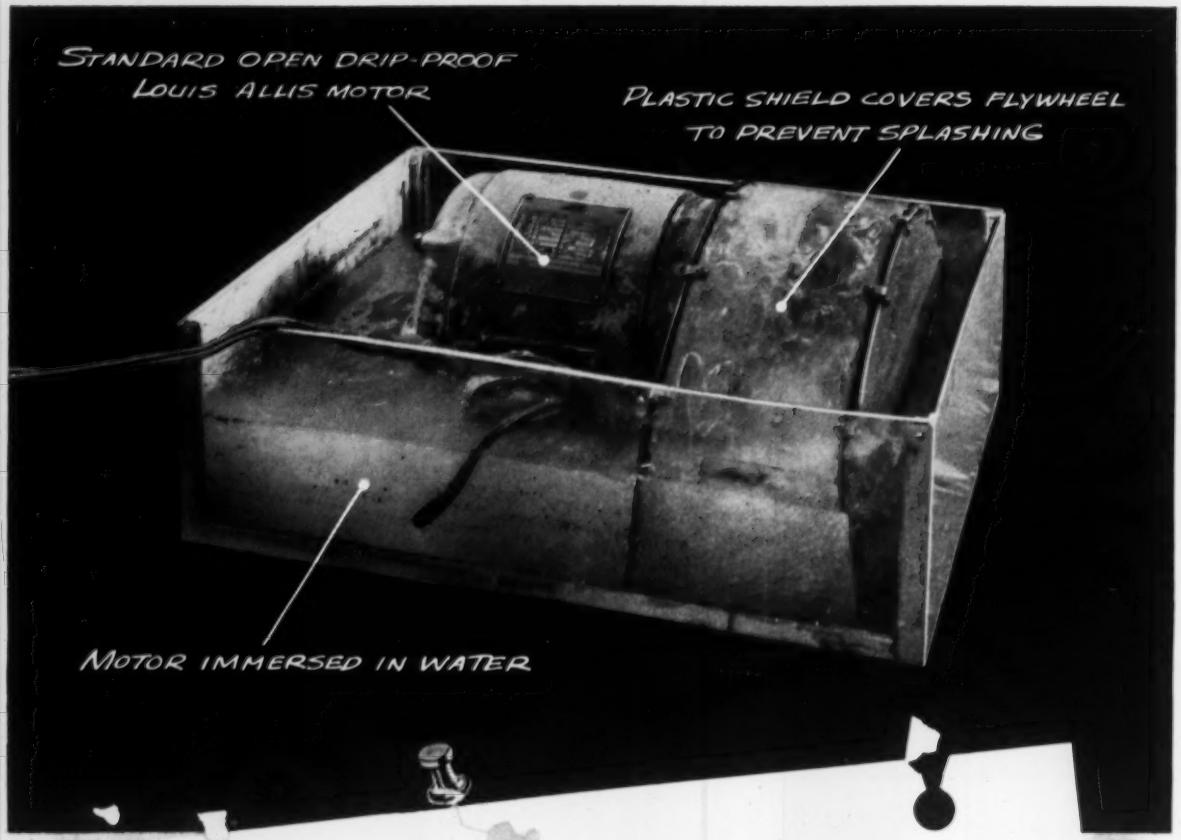
Call one of Garlock's 125 factory trained representatives for *unbiased* recommendations, or write for Expansion Joint Folder AD-137.

THE GARLOCK PACKING COMPANY, Palmyra, New York

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints



In water 1½ years...still running

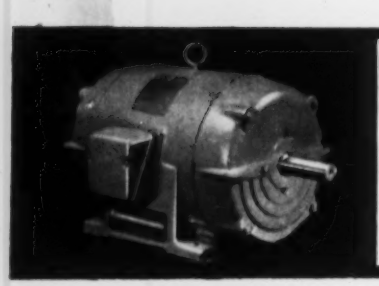
Dramatic proof that Louis Allis motor insulation provides unusual moisture resistance

We wouldn't do this to a motor. But somebody did, to check our new insulation. They took a standard open drip-proof motor, placed it in water up to the shaft, and ran it a year and a half.

The motor will still run, too, which proves that our insulating materials are of top quality. One of our exclusive features is the new phenolic impregnating varnish we use. As you can see, this varnish resists moisture, but it also has excellent thermal and chemical resistance and is not susceptible to embrittlement.

Insulation usually determines the life of a motor. That's why the insulating materials used in the new L. A. line are the product of years of continuous research and development. That's why Louis Allis motors run longer . . . give less trouble.

Find out the many other advantages available to you in the new L. A. line of motors. Write for our new bulletin No. 1700.



A complete line of standard rerated motors in frames 182 through 326U now in stock. Special rerated motors are available on short delivery.

LA-107

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

can you identify these marks?

Going back to ancient times craftsmen identified themselves by symbols of their particular art.

In many cases, as with silversmiths and other artisans, this mark was carried on the finished product as a symbol of master craftsmen.

Today each length of Wheatland steel pipe carries its own identification—welded into each length of "The Pipe with the Yearmark" are the words—*WHEATLAND '56.*

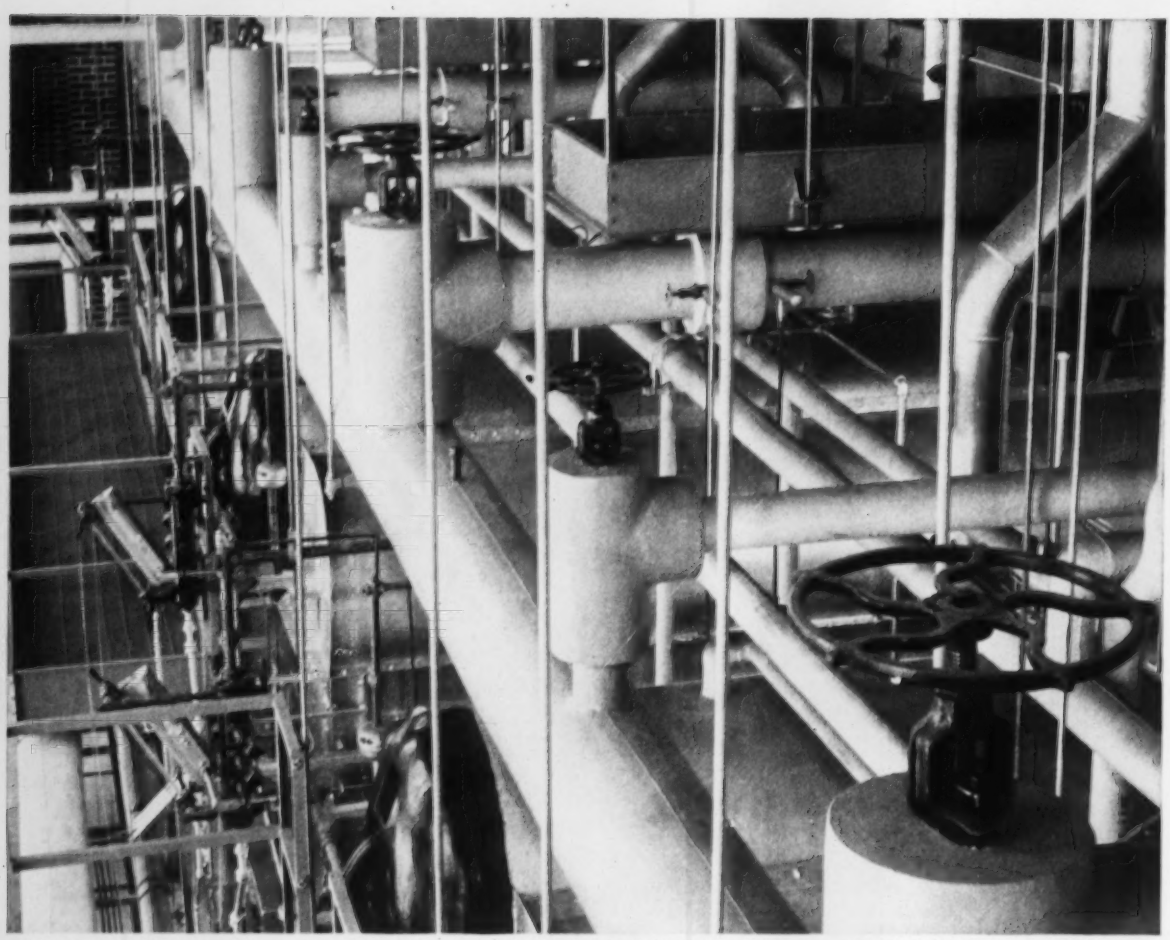
This is our mark of fine, dependable, uniform workmanship. Made by men who know pipe, who understand your piping problems.

Next order specify Wheatland, the pipe with the Yearmark.

WHEATLAND TUBE COMPANY

BANKERS SECURITIES BUILDING, PHILADELPHIA 7, PA.

MILLS • WHEATLAND, PA. • DELAIR, N. J.



THE PERFECT HEAT-SAVER for temperatures up to 600°F. is K&M "Featherweight" 85% Magnesia. Note the well-insulated headers, valves and piping in this college building boiler room.

Permanent Insulation Efficiency with K&M "Featherweight" 85% Magnesia

Good for the life of the equipment it insulates . . . that's K&M "Featherweight" 85% Magnesia. There's no gradual loss of insulating effectiveness to push heat-piping costs up . . . regardless of time in use.

This is a great K&M product, proved superior in countless applications. "Featherweight" 85% Magnesia withstands moisture, vibration, frequent temperature changes. It is always easy to handle and install. It is the most practical, efficient insulation ever made for temperatures up to 600° F.

THERE IS A COMPLETE LINE OF K&M INSULATIONS. For temperatures that range up to 1900° F., there are K&M insulations that efficiently keep heat where it is wanted. Each is widely used throughout industry.

For more information on heat-saving, money-saving K&M insulations, contact your K&M distributor who is an experienced applicator. Or write directly to us.

K&M LOW-PRESSURE INSULATIONS

K&M Air Cell Pipe, Sheet and Block Insulation
K&M Fine Corrugated Air Cell Pipe, Sheet and Block Insulation
K&M Special Fine Corrugated Air Cell Pipe, Sheet and Block Insulation
K&M Simplex "Super Shrunk" Pipe Insulation
K&M Bestfelt Lamino Sponge Pipe and Block Insulation
K&M Duplex Pipe Insulation
K&M Nu-Wrap Non-Sweat Sectional Pipe Insulation
K&M Ambilerex No. 2 Insulating Cement
K&M No. 152 Asbestos Finishing Cement

K&M HIGH-PRESSURE INSULATIONS

K&M "Featherweight" 85% Magnesia Pipe and Block Insulation
K&M Hy-Temp Pipe and Block Insulation
K&M "Featherweight" 85% Magnesia Cement
K&M Hy-Temp Cement
K&M KaytherM Block Insulation

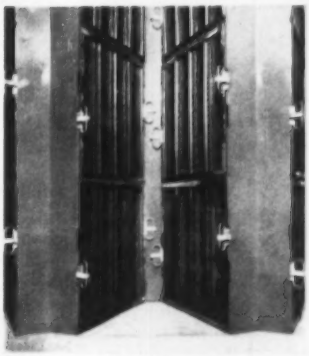
KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M Asbestos

CONTINENTAL
clears the air...
for the huge
NEW YORK COLISEUM

Owner	Triborough Bridge & Tunnel Authority
Architects	Leon & Lionel Levy
Consulting Architects	Eggers & Higgins John B. Peterkin Aymar Embury II
General Contractors	Walsh-Fuller-Slattery
Heating & Ventilating Contractors	Almirall & Company, Inc.
Structural Engineer	Dr. Jacob Feld
Mechanical & Electrical Engineers	Guy B. Panero Associates

1400 Continental low-velocity filters, installed in 28 fan systems, handle more than 1,000,000 CFM in this monumental building. Close-ups of actual filter banks show "V"-type installation.



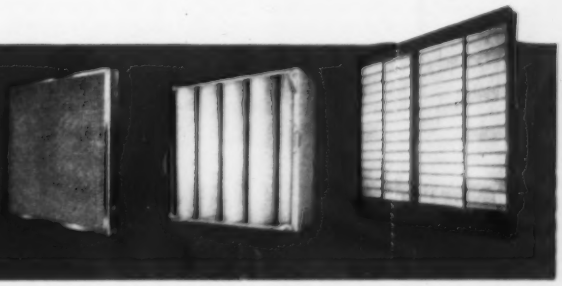
Continental's LV-4 filters offer tremendous dust-holding capacity with excellent efficiency at low initial cost. Carefully designed to eliminate rapid surface-loading, they assure a longer service period at relatively low resistance.

There's a Continental product engineered to best fill your air filtration need. Don't guess . . . check with your nearest Continental representative or write direct.

AIR CONTINENTAL FILTERS

P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



for lower cost control of moderately **Corrosive** fluids

Fig. 2651-A Gate

JENKINS

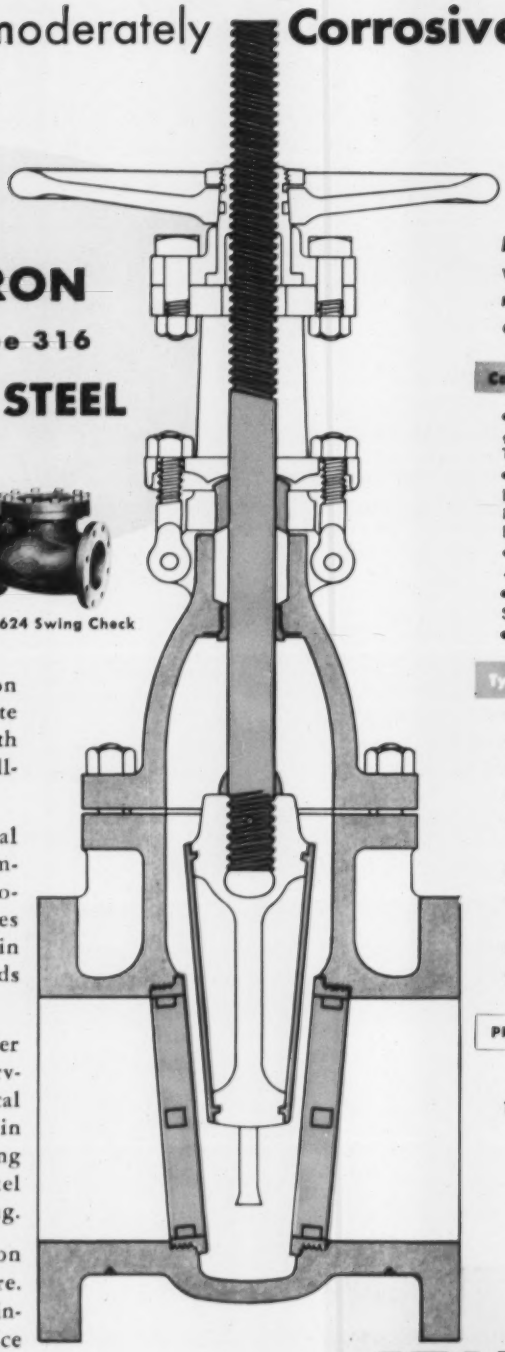
NICKEL IRON

Valves with Type 316

STAINLESS STEEL

Trim

Fig. 2624 Swing Check



This combination provides corrosion resistance well above the moderate need in many processing services with an investment well below that for all-stainless steel valves.

Designed primarily for the chemical process industries, they are recommended for control of mildly corrosive liquids with minimum quantities of mineral acids, such as creosote in wood treatment, and many liquids carried in petroleum processing.

A major use is in pulp and paper processing, particularly in lines serving the digester, and in the chemical recovery cycle. Service records in lines carrying the valve-punishing "black liquor" give Jenkins Nickel Iron Valves top performance rating.

Jenkins *extra value* construction throughout. Get details — compare. See why they stretch your valve investment dollar — with longer service life, lower maintenance cost.

ALSO RECOMMENDED for fluids used in electroplating, photograph finishing, textile bleaching, dyeing and finishing and heat treating of metals.

Every part in contact with fluid is the right metal to block corrosion and beat wear.

Cast NICKEL IRON

- **BODIES** Heavy duty, dimensioned for greater resistance to wear and abuse. Through port design in Gate Valves.
- **BONNET** Rugged construction, like body. Swing-type gland bolts. Screwed-in back-seating bushing. Deep stuffing box.
- **YOKE** Integral with bonnet in 2" to 4" sizes.
- **WEDGE** In 10" to 24" sizes, with Stainless Steel Wedge Rings.
- **COVER** In Check Valve.

Type 316 STAINLESS STEEL

- SPINDLE
- GLAND
- BONNET BUSHING
- SPINDLE RING
- WEDGE of I-beam structure in 2" to 8" sizes.
- WEDGE PIN
- WEDGE RINGS Rolled into Nickel Iron Wedge in 10" to 24" sizes.
- SEAT RINGS
- DISC and HANGER in Check Valve

PRESSURE RATINGS

2" to 12"—200 lbs. O.W.G.
14" to 24"—150 lbs. O.W.G.

GET COMPLETE SPECIFICATIONS from your Jenkins Valve Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17. Ask for Bulletin 118.

JENKINS VALVES

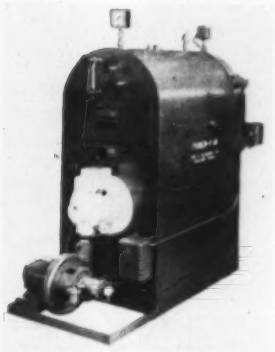
LOOK FOR THE DIAMOND MARK

SINCE 1864 JENKINS

Jenkins Bros.

EQUIPMENT DEVELOPMENTS

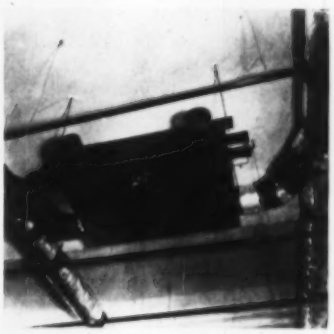
For reviews of Recent Trade Literature see Page 232



Low Pressure Boiler . . .

. . .for oil, gas firing—*Orr & Sembower, Inc., Dept. HPAC, Box 1138, Reading, Pa.*

"Power-Pak" designed to provide steam, hot water heating, hot water service with power demands 10, 15, 20, 25 hp. For smaller schools, office buildings, apartments, greenhouses, hospitals, churches. Also may find auxiliary use in large industrial plants, warehouses, says company.



Air Conditioning . . .

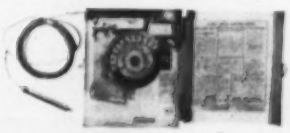
. . .for office spaces where future changes in floor plans may require shifting of outlets—*Anemostat Corp. of America, Dept. HPAC, 10 E. 39th St., New York 16.*

"Octopus" unit allows single high velocity attenuator to feed up to four diffusers. Diffusers are of same dimensions as ceiling acoustic panels, are fed from attenuator through flexible fireproof hose, so that office space may be subdivided or re-allocated, says company.

Air Conditioning . . .

. . .line featuring new 1½ hp room unit, 1 hp reverse cycle (heat pump) model—*Frigidaire Div., General Motors Corp., Dept. HPAC, Dayton 1.*

Window unit line, designed for faster pull-down, greater capacity and high power factor, offered in "Deluxe" and "Super" series in ¾ to 1½ hp models. Both series contain new single reciprocating type refrigeration compressor, says company.



Time Switch . . .

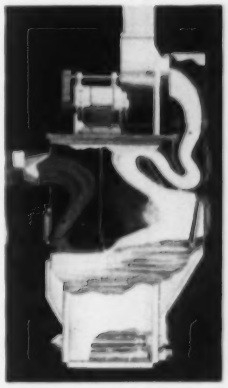
. . .designed to regulate hours of heat in building, divide day into three periods of heating—*Automatic Devices Co., Inc., Dept. HPAC, 711 Hillgrove Ave., Western Springs, Ill.*

"Weather-Chron" contains two switch circuits. First operates burner or valve, with only safety high-limit controller in circuit regulating heat generation or flow. At preselected time, second switch of timer connects "daytime" heat flow controller with circuit to provide regulated heat flow throughout day. Heat flow stopped or reduced at preselected nighttime hour. In one-day, seven-day models.

Electrode . . .

. . .designed for application as first step in retreading carbon steel parts —*All-State Welding Alloys Co., Inc., Dept. HPAC, 249-55 Ferris Ave., White Plains, N. Y.*

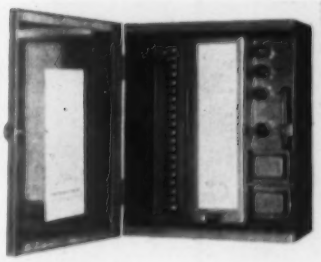
"Roll Matrix" is wear resistant but not classed as hardsurfacing rod — intended to be overlayed with harder alloy. Available in ⅛, 5/32, 3/16, and ¼ in. core diameters.



Wet Dust Collector . . .

. . .for controlling industrial dusts —*Pangborn Corp., Dept. HPAC, Hagerstown, Md.*

"Ventrijet" achieves proper atomizing of water and mixing with air stream to permit efficient dust transfer by movement of air without mechanical means, says company. In capacities 1000 to 30,000 cfm, in single, double row tube types.



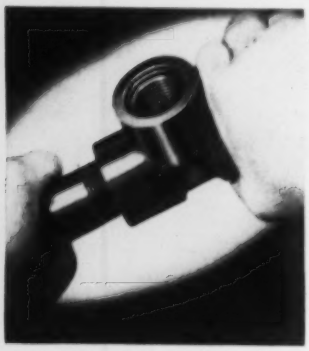
Relays . . .

. . .for oil, gas, combination burner control—*Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2641 Fourth Ave., S., Minneapolis 8.*

"Protectorelays" in two new models said to feature sensitive electronic flame detection, wide choice of control sequences and timings, safe-start component check. "R478A" uses two-flame rectification detection circuits for use with either flame rod or standard photocell or both. "R478B" features flame-guard lead sulphide photocell sensing unit for both gas, oil burners.

EQUIPMENT DEVELOPMENTS

Continued



Plastic Pipe . . .

. . .formulated for chemical resistance, high bursting strength, toughness—*American Hard Rubber Co., Dept. HPAC, 93 Worth St., New York 13.*

"Rivielor" extruded of special polyvinyl chloride compound, says company. Is said to be easy to cut, thread, assemble without breakage or damage. Designed to resist weather and aging; to be nontoxic, inert, odorless, tasteless. In sizes ½ to 2 in. with standard or heavy wall construction. For pressures 255 to 190 psi at 70 F.

Saw . . .

. . .designed exclusively for cutting copper—*Collins Machinery Corp., Dept. HPAC, 5474 Alhambra Ave., Los Angeles 32.*

Is said to cut without burr on inside or outside to eliminate reaming. Seven to eight pieces of ¾, 1½ in. copper tubing can be cut at one time, says company. Power supplied by any 110 volt outlet. Made of aluminum for portability, weighs 90 lb.

Louver . . .

. . .for unit ventilators—*Herman Nelson Unit Ventilator Products, American Air Filter Co., Inc., Louisville 8.*

Is said to permit greater ease of installation of heating, ventilating, cooling units in schools where curtain wall construction is employed. Available in aluminum or steel. Purpose of development was to make available louver which could be adapted to any thickness of panel or "sandwich" wall, or with wood frame wall, says company.

Duct Insulation . . .

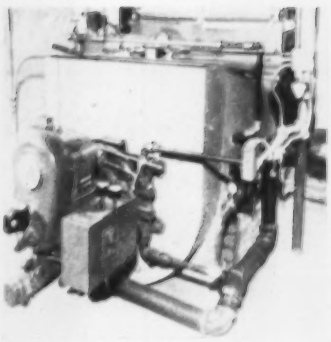
. . .for application to exterior, interior duct surfaces—*Baldwin-Hill Co., Dept. HPAC, 500 Breunig Ave., Trenton, N. J.*

Felted from mineral wool fibers. In three types: plain, with integral vapor barrier for application on duct exteriors; neoprene coated for application on duct interiors. Comes in 24 x 48 in. sheets, ¾, 1, 1½ and 2 in. thick; density of 6 lb per cu ft, thermal conductivity of 0.24 Btu in. per hr, sq ft, deg F at 75 F, and will withstand temperatures of 450 F, says company.

Valves . . .

. . .of stainless steel construction—*Associated Valve & Engineering Co., Dept. HPAC, 1150 W. Marquette Rd., Chicago 21.*

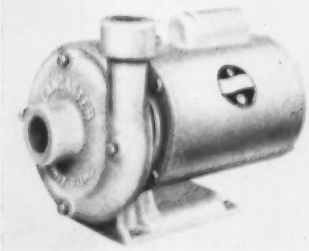
Available in sizes ½ to 1½ in. Body is self-draining type. Designed specifically for nuclear applications. Completely sealed by lip weld after assembly, says company.



Water Wall Furnace . . .

. . .engineered to increase boiler capacity—*Preferred Utilities Mfg. Corp., Dept. HPAC, 1360 Broadway, New York.*

To be incorporated with standard burner equipment for installation on existing boilers. Also available with horizontal rotary oil burner, as part of packaged "Thermopak" combustion system. Cited features: improved circulating characteristics, increased life expectancy of existing boiler equipment, increased boiler capacity, improved efficiency, reduction in combustion chamber maintenance.



Pumps . . .

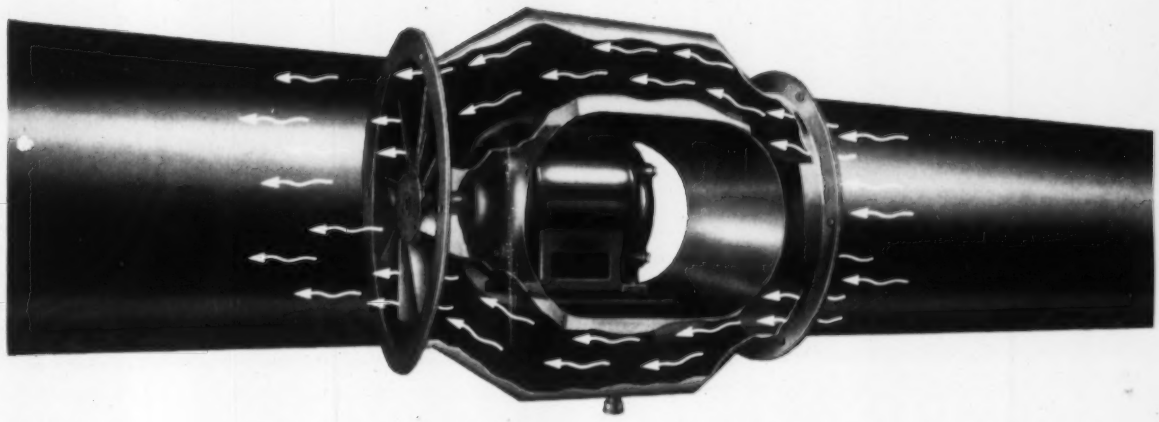
. . .for air conditioning, refrigeration applications—*Lancaster Pump and Mfg. Co., Dept. HPAC, Manheim Rd., Lancaster, Pa.*

Close coupled units supplied with ceramic seat seals as standard equipment on models to 7½ hp. Cited features are all bronze impellers and shaft couplers, four-position indexing for ease of installation.

Compressor . . .

. . .adaptable to available gas turbine drive—*York Corp., Dept. HPAC, York, Pa.*

"Turbomatic" unit in capacities 115 to 350 tons. Particularly suited to gas turbine drive in areas where



NO CHARGE

for the most important part of BIFURCATOR® fume removal

You pay nothing extra for DeBothezat's 30 years' experience in solving corrosive fume problems. DeBothezat know-how is the reason for the designed-in efficiency of this split-housing fan — and for the competent assistance you get in *applying* this fan to your specific fume-removal problem. You can specify a DeBothezat Bifurcator . . . install it . . . forget it. It will be right for your job. It needs no attention besides an occasional routine check-up. It runs day in and day out, trouble free.

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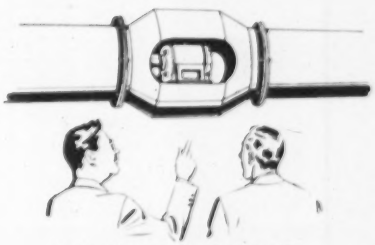

APPLICATION EXPERIENCE

De Bothezat FANS

A DIVISION OF

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American Machine and Metals, Inc.
East Moline, Illinois

☐ Send Bulletin DB-37-55 containing complete data on the Bifurcator for exhausting corrosive fumes.

☐ Have a DeBothezat representative call.

COMPANY

ADDRESS

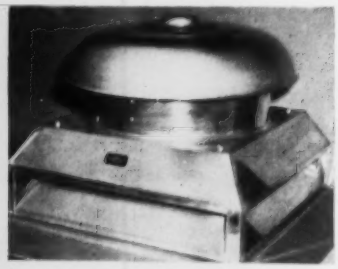
CITY ZONE STATE

ATTENTION MR.

EQUIPMENT DEVELOPMENTS

Continued

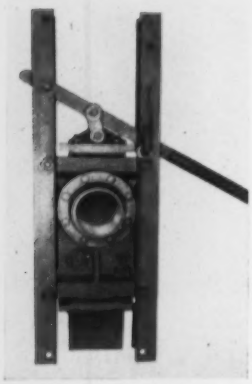
natural gas available as fuel for powering air conditioning equipment, company says. In this application, gas piping directly connected to turbine drive.



Roof Ventilator . . .

. . . v-belt driven, centrifugally powered—*Uno Ventilator Co., Dept. HPAC, 1236 Eastern Ave., Malden 48, Mass.*

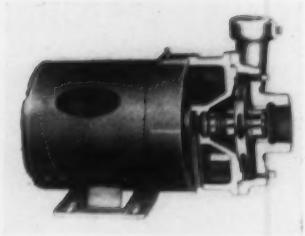
"Package" type features aluminum spark-proof impellers, is nonoverloading in design, says company. Shipped complete with square mounting frame ready for placing over purchaser's roof curb.



Slide Valve . . .

. . . for use to sectionalize branches of piping system to direct flow through desired course—*Allen-Sherman-Hoff Co., Dept. HPAC, 259 E. Lancaster Ave., Wynnewood, Pa.*

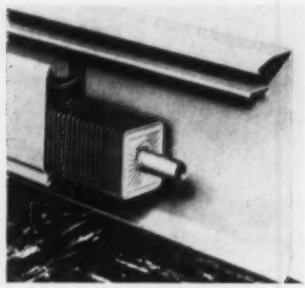
Designed for pipelines transporting solid materials in liquids, says company. Available in 6, 8, 10 in. sizes for maximum pressure of 125 psi. In models for either manual or power operation.



Centrifugal Pump . . .

. . . designed for air conditioning service—*The Deming Co., Dept. HPAC, Salem, Ohio.*

Units suited for general circulating duty, industrial plant service, other applications. Sizes range from 1/3 to 5 hp with capacities to 140 gpm. Cited features: all bronze enclosed type impeller, renewable bronze wearing ring, stainless steel shaft, rotary type shaft seal.



Baseboard Radiation . . .

. . . for hot water perimeter heating—*Fedders-Quigan Corp., Dept. HPAC, Box 1690, Trenton 7, N.J.*

"Model L" fabricated of copper tube, aluminum fins spaced 43 per ft. Fins mechanically bonded to tube, corrugated for strength and mounting holes equipped with flanged collars for larger area contact with tube, says company. Through mandril expansion, tubing is expanded at fin junctures for tight fit, efficient heat transfer.

Polyethylene Pipe . . .

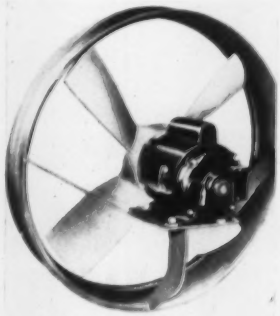
. . . for general purpose use not requiring extra pressure protection—*Chesflex Corp., Dept. HPAC, 684 Nepperhan Ave., Yonkers, N.Y.*

In sizes ½ to 4 in. Recommended by company for low pressure applications, industrial piping of corrosive liquids. Manufacturer has also added line of nylon fittings.

"Duplex" Compressor . . .

. . . water chilling units in 800 to 1200 hp size range—*Trane Co., Dept. HPAC, La Crosse, Wis.*

"Duplex CenTraVac" recommended by company for air conditioning installations demanding high tonnage capacities. Compressors located on same side of single, large evaporator and condenser. Cited features: capacity control, hermetic operation, low noise level, freedom from vibration, automatic operation, gas cooled motors, load limit control.



Propeller Fan . . .

. . . for air moving applications requiring low noise levels—*Robbins & Myers, Inc., Dept. HPAC, Springfield, Ohio.*

Direct-connected axial flow units for use in offices, stores, restaurants, laboratories, institutions, other applications, says company. In six sizes 12 to 36 in., with delivery ratings to 12,000 cfm.

Variable Speed Motor . . .

. . . with takeoff shaft and motor on same side—*U. S. Electrical Motors Inc., Dept. HPAC, Box 2058, Terminal Annex, Los Angeles 54.*

Ideal for low-speed applications requiring variable speed, where weight

These B&W Elbows Need Less ELBOW ROOM

ELBOW room was at a premium in this piping manifold. Fabricators chose B&W Fittings because they're easy to install, especially in a job like this which calls for "close-quarter" welding. Installation went ahead fast and without trouble, thanks to the accurate dimensions of the B&W Welding Ells used.

Maintenance, too, will be kept at a minimum because, with a sound weld, piping is permanent and leakproof. B&W Seamless Welding Fittings and Flanges are available in a complete range of grades, types, sizes and pipe schedules.

THE *NATURAL* SOURCE FOR ALLOY FITTINGS

B&W TUBULAR PRODUCTS DIVISION

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
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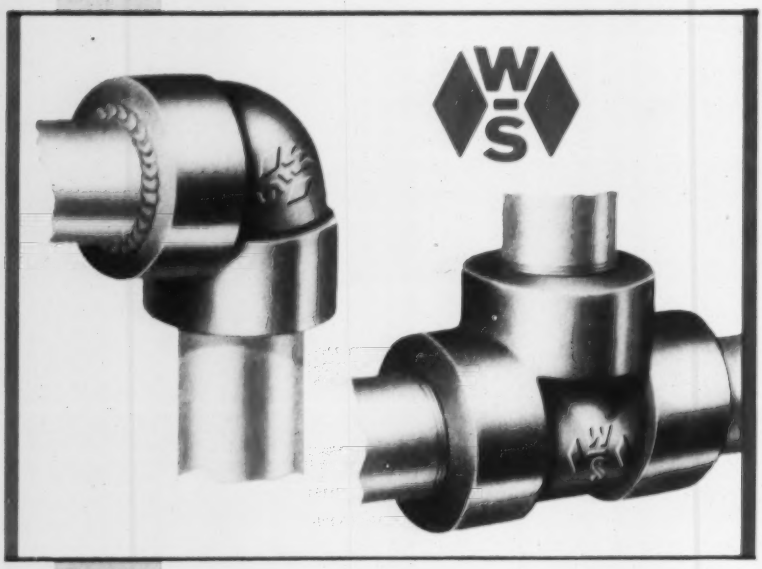
Seamless welding fittings and flanges, seamless and welded tubular products — in carbon, alloy and stainless steels.

2 Safe Ways to PROTECT Pressure Piping...



W-S SCREW-END and SOCKET-WELDING FORGED STEEL FITTINGS

Pipe joints are potential trouble spots in high pressure piping systems. Change in direction of flow causes turbulence, erosion and vibration. Watson-Stillman fittings are made to absorb this type of punishment. They're drop-forged for strength and toughness and safety-factor designed for the protection of your piping.

Choose between a welded piping system and a screwed one to suit your needs. Then choose W-S Screw-End or Socket-Welding Fittings to join your pipe. They're available in sizes ⅛" to 4" for piping up to 6000 lb. W.O.G. class. For high temperature or corrosive service you can get W-S Forged Stainless and Alloy Steel Fittings, too. Send today for our informative catalogs.

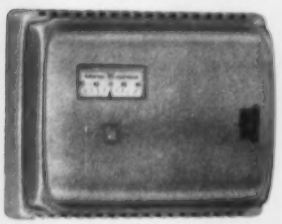
W-S FITTINGS DIVISION

H. K. PORTER COMPANY, INC.
Roselle, New Jersey

EQUIPMENT DEVELOPMENTS

Continued

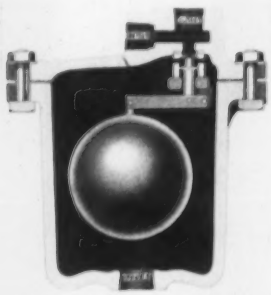
distribution and limited space are factors, says company. Has asbestos-protected windings, heat-treated castings. Available up to 5 hp.



Thermostat . . .

. . .for direct control of unit heaters, circulators, motors, fans—*General Controls Co., Dept. HPAC, Skokie, Ill.*

Cooling model of line voltage unit designed for direct control of air conditioning, cooling, ventilating. Available with or without cooling or heating anticipation. Contacts sealed against moisture, dust, corrosive substances.

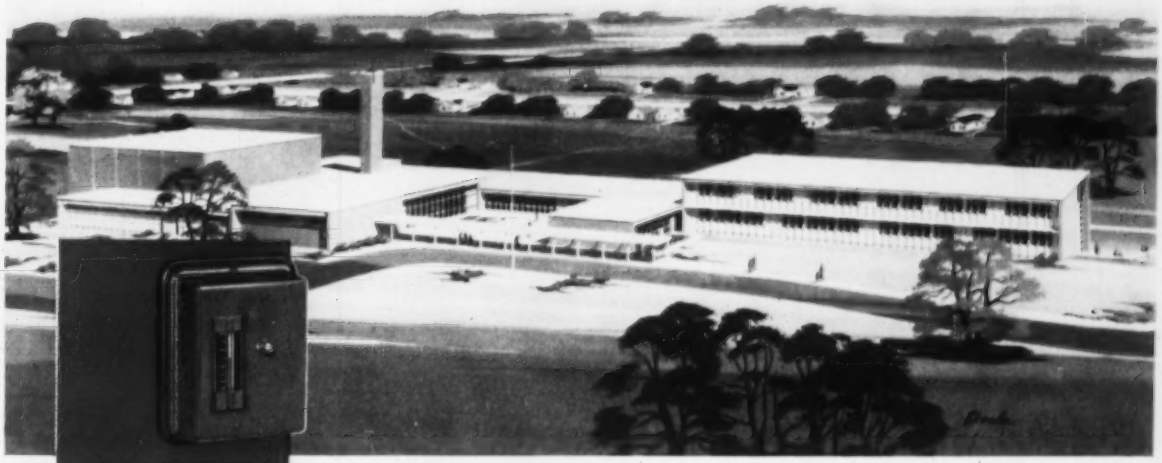


Venting Traps . . .

. . .engineered to "automatically" discharge accumulated air, gas at high points of liquid or closed system—*Clark Mfg. Co., Dept. HPAC, 1330 E. 33th St., Cleveland 14.*

Designed to withstand temperatures to 450 F to 250 psi, low temperatures to 300 psi, in semi-steel; fabricated steel to 750 F to 600 psi and for low temperatures to 1000 psi. Furnished with stainless steel ball float or noncollapsible stainless steel open-end float. Valve points are guided to assure positive closing, says company.

where there's an "after hours" heating problem...



JOHNSON DUAL CONTROL

Cuts the Cost of Comfort

Northeast Junior High School* is another outstanding example of the way the Johnson *Dual* System of Automatic Temperature Control solves the very special comfort problems of the modern school and provides waste-free heating and ventilating performance.

During regular school hours, sensitive Johnson *Dual* Thermostats, in each individual room, maintain ideal temperatures throughout the entire building. They operate, automatically and efficiently, the Johnson Valves and Damper Operators which control the heating and ventilating effect of convectors and unit ventilators. Refreshing, even temperatures prevail at all times, regardless of outdoor temperatures, exposure, occupancy levels and other variable factors which might otherwise affect student and teacher comfort.

When regular school hours end, each of five groups of *Dual* Thermostats is reset, from a central point, to operate at lower, non-occupancy temperatures. In those rooms that continue in use, merely pressing a button on the room's *Dual* Thermostat restores it to normal occupancy temperature, *without changing the economy settings of the other thermostats.*

Any room, or rooms—auditorium, multi-purpose room or individual classrooms—may be used independently and at minimum cost, since *only the occupied rooms are heated.* With Johnson *Dual* Control, "after-hours" heating problems are completely eliminated and, in the typical school, fuel savings quickly repay the cost of the entire system!

Johnson offers you the benefits of more than 70 years' experience in designing, manufacturing, installing and servicing automatic temperature control systems. With Johnson, all responsibility is centered in one highly specialized organization—the only way to insure the most efficient control installation for every type of building.

A nearby Johnson engineer will be glad to work with you on any control problem. His recommendations are yours without obligation.

*Northeast Junior High School, Johnson County, Kansas. Architects—Peterson & Scharhag, Kansas City, Mo., and Perkins & Will, Chicago. Mechanical Engineers—Howarth, Scott & Kinney, Kansas City, Mo. Heating Contractor—Interstate Heating & Plumbing Co., Kansas City, Mo.

JOHNSON CONTROL
TEMPERATURE AIR CONDITIONING

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507-B East Michigan Street, Milwaukee 1, Wisc.

I'd like more facts about *Dual* Control.

☐ Send your folder "How Johnson *Dual* Control Solves the After-Hours Heating Problem in Schools."

☐ Have a Johnson engineer call me.

NAME

SCHOOL

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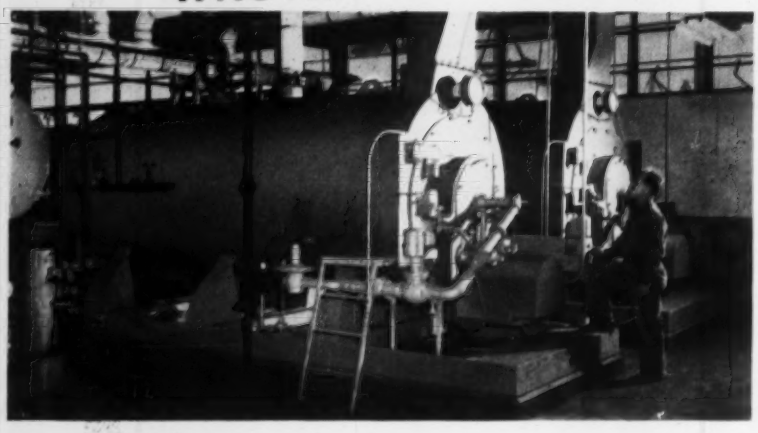
CITY & STATE

THERE'S $5,949.81 WORTH of READING

IN THIS STORY CYCLOTHERM WROTE!



Too high—said the Zion Cooperative Mercantile Institute, Salt Lake City, of its 1953-1954 heating costs. ZCMI is the largest wholesale distributor in the intermountain area.

So ZCMI installed two Cyclotherm Steam Generators (150 and 250 hp). And from October, 1954 to June, 1955, even in a colder winter and with additions to the ZCMI plant, Cyclotherm saved ZCMI $5,949.81.

For full information on how ZCMI saved money with Cyclotherm—together with a month-by-month before-and-after table of ZCMI's heating costs—write to Cyclotherm today. You'll join the thousands of satisfied Cyclotherm users who report *more heat with less fuel.*

In Cyclotherm Cyclonic Combustion, air combines with fuel to form a vortex of flame, revolving at 200 miles per hour, providing maximum heat transfer. Cyclotherm is a complete package steam or hot water generator, 5 connections make it ready to work. From 18 to 500 hp, 15 to 200 psi. Meets all state requirements, A.S.M.E. and National Board Standards, is approved by Underwriters Laboratories, Inc. Write for complete booklet on Cyclotherm Cyclonic Combustion today.

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RADIATOR CORP.
Dept. 2629 Oswego, N.Y.

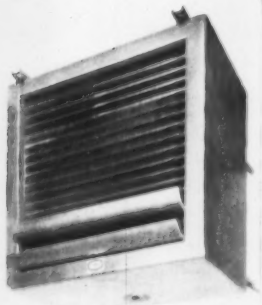
EQUIPMENT DEVELOPMENTS

Continued

Centrifugal Pump . . .

. . . designed to accommodate fluctuating volume, head—*Gardner-Denver Co., Dept. HPAC, Quincy, Ill.*

"Model BL" is said to provide high efficiency over broad range of service conditions. In 2, 3, 4, 5, 6 in. sizes. With factory lubricated, "heavy duty" ball bearings. Mechanical seal replaces stuffing box.



Unit Cooler . . .

. . . designed for high efficiency—*Dole Refrigerating Co., Dept. HPAC, 5910 N. Pulaski Rd., Chicago 30.*

For low temperature applications. Is said to maintain frost free unit cooler coil. Available in matched "Unit-Cooler" and "Heat-Cel" sets or as separate item.

Cutoff, Beveling . . .

. . . machine with "fast action" oxygen cutting torch—*Speedi-Burn Products Co., 534 Linden St., West Hempstead, N. Y.*

Torch mounted radially, makes complete revolution around work, says company. Safety limit switches stop rotation at completion of cut. Available to handle up to 24 in. diameter pipe.

Refinery proving ground confirms superiority of Triple-Zone Gilsulate for hot underground pipes

"...pipes looked absolutely new...insulating efficiency equal to or better than any other...cost of the GILSULATE *system has been appreciably lower."*

—R. W. AYER, Chief Engineer, Salt Lake Refining Company

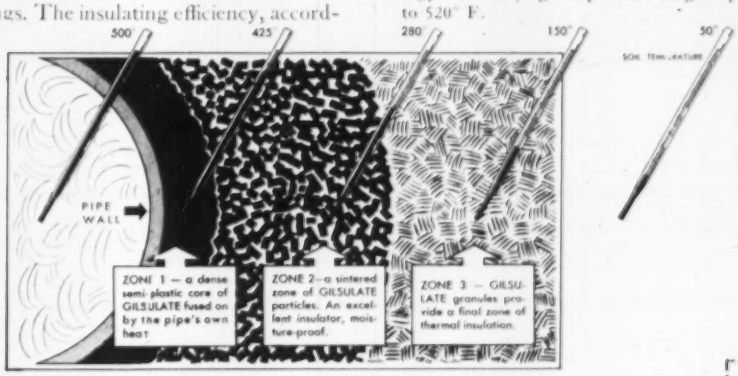
Salt Lake Refining Company confirms the findings of hundreds of GILSULATE® installations throughout the country: this *triple-zone insulation* succeeds where others have not fulfilled all operating conditions—*and at lowest cost per installed linear foot.*

Research excavation of the initial GILSULATE installation at Salt Lake Refining Company, after 14 months of service, proved to their engineering and maintenance staff that this new insulation functioned at peak efficiency. Both lines—one of steam, one of water—were in excellent condition, with no evidence of pitting or scaling. Additional GILSULATE installations have been made since by the company for utility services and for road crossings. The insulating efficiency, according to their chief engineer, is "equal to or better" than any of the various other types of installations—and "at a cost that is appreciably lower."

Investigate the values of this easily installed, low-cost insulation yourself. Use the coupon below for complete information, or see your local GILSULATE distributor.

FACTS ABOUT GILSULATE

1. *Easy to use*—just pour, tamp and backfill... pipe heat does the rest.
2. *Forms 3 zones of protection* against heat loss and all commonly encountered hazards to hot buried pipes.
3. *Needs no* sleeves or mechanical sheaths: no mixing or special handling.
4. *Needs only* normal pipe spacing: for multiple pipe or cramped conditions.
5. *3 types* for varying temperature ranges up to 520° F.


500°
425°
280°
150°
50°
SOIL TEMPERATURE
PIPE WALL
ZONE 1 — a dense semi-plastic core of GILSULATE fused on by the pipe's own heat
ZONE 2—a sintered zone of GILSULATE particles. An excellent insulator, moisture-proof.
ZONE 3 — GILSULATE granules provide a final zone of thermal insulation.

Installing new GILSULATE *system is simply a matter of pouring (note metal forms to conserve material), tamping down...and backfilling.*

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF HOT UNDERGROUND PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY, SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

American Gilsonite Co.
154-G West Broadway, Salt Lake City 1, Utah — or — 1145 East Jersey St., Elizabeth, N. J.

Send me more information on GILSULATE Insulation

NAME

TITLE

COMPANY

ADDRESS

HPA

Unbeatable

for fast, clean pipe or conduit cutting . . .

efficiency-balanced

RIDGID

Heavy-Duty

Pipe Cutter

It's a tool that knows its business, that comes to your hands like an old friend. It rolls easily through any pipe or conduit, scarcely a trace of burr. Strongly built, guaranteed not to warp or break, always tracks perfectly. Thin-blade or heavy-duty cutter wheels (special wheels for stainless or cast iron). For pipe or conduit cutting that's a satisfaction, buy RIDGID's at your Supply House.

7 models for ⅛" to 6" pipe and conduit

RIDGID 4-WHEEL for easy cutting in tight places

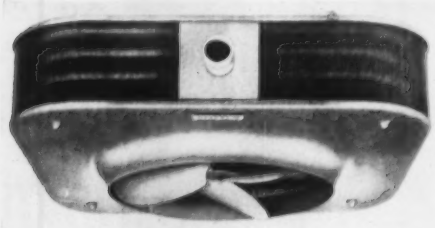
RIDGID

Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U. S. A.

EQUIPMENT DEVELOPMENTS

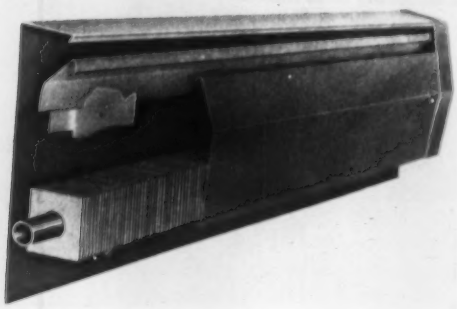
Continued



Unit Heater . . .

. . . designed to operate with steam or hot water — *Warren Webster & Co., Dept. HPAC, Camden 5, N.J.*

Is of draw-through type and utilizes rectangular wrap-around heating elements. Heating elements constructed of copper tubing with extended corrugated-aluminum plate-type fins. Capacities range 34,000 to 634,000 Btu per hr.



Baseboard . . .

. . . designed for easy installation — *Embassy Steel Products, Inc., Dept. HPAC, 390 Stanley Ave., Brooklyn 8.*

For assembly without screws, bolts. Available in many capacities, says company, depending on water pressure. In lengths to 8 ft. Use ¾ in. copper tube. Are 9¼ in. high.

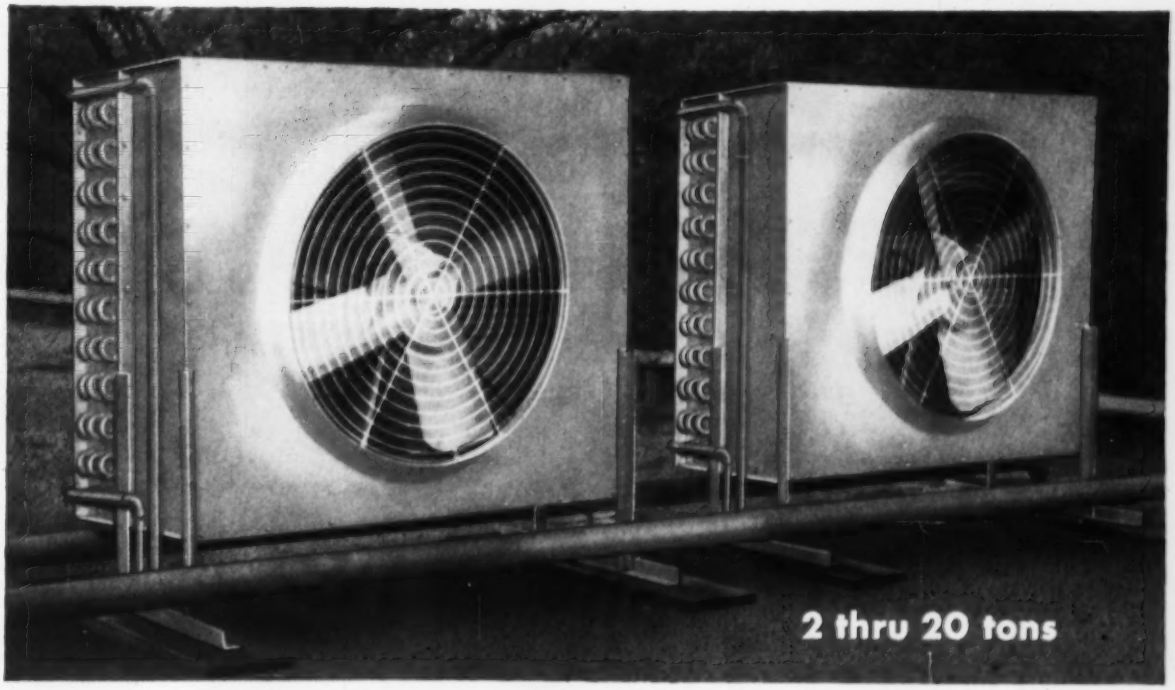
Muffler . . .

. . . for use in reducing pumping noise in air conditioning, refrigeration systems — *Heat-X, Inc., Dept. HPAC, Brewster, N. Y.*

Installed on discharge line of refrigeration compressor, unit eliminates pulsations, vibrations in lines, says company. Features seamless pipe, all welded steel construction. Expansion chambers, baffles designed for maximum efficiency, minimum pressure drop.

So Halstead & Mitchell Engineers said:

"LET'S GIVE THIS INDUSTRY A BETTER AIR-COOLED CONDENSER"



Now we proudly call to your attention the Halstead & Mitchell Air-Cooled Condenser for waterless air conditioning and refrigeration. This is today's *better* remote Air-Cooled Condenser.

It is engineered to a new principle called "Co-ordinated Design," and this is engineering pioneering which has coordinated capacity, performance, structural design and appearance to give:

1. Extra-Safe Capacity Ratings — made possible by a unique "dimpled" fin *giving 15% added heat transfer*, as well as a core designed for higher air volumes at lower fan speed.

2. Extra Years of Working Life — insured by exclusive, proven Halstead & Mitchell protection against corrosion; lifetime ball bearings; and a tubing assembly pattern which is self-reinforcing and thus deadens vibration before it starts.

3. Extra-Quiet Operation—which is the direct result of deep-pitch fan blades driven at slow speeds.

4. Extra-Easy Multi-Circuiting—developed for Halstead & Mitchell remote Air-Cooled Condensers by engineers who know what simpler manifolding and selection of circuits can mean when several air conditioning and refrigeration machines must work off a single coil.

Even more important, you know these Air-Cooled Condensers bring you—with their Halstead & Mitchell nameplate—an assurance of the highest quality in the industry. Whether you are jobber, contractor, architect or manufacturer (and we'll be pleased to give quantity quotations), order Halstead & Mitchell "Co-ordinated Design" for *the better Air-Cooled Condenser.*

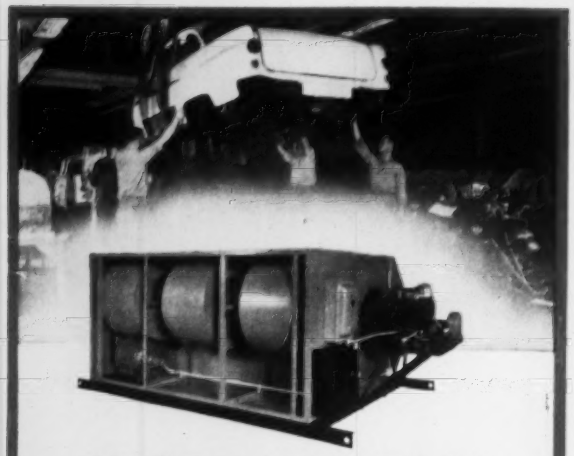
WRITE FOR BULLETIN AC-100

Halstead & Mitchell

BESSEMER BUILDING, PITTSBURGH 22, PA.

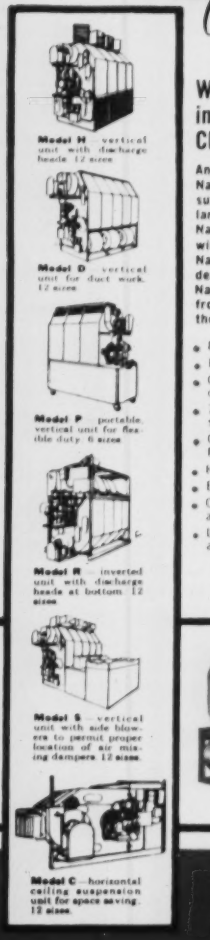
Manufacturer of THE INDUSTRY'S WIDEST SELECTION OF COOLING TOWERS

World's Largest Manufacturer of WATER-COOLED, CLEANABLE CONDENSERS



LEADING AUTOMOBILE MANUFACTURERS place their confidence in

NATIONAL Champion
DIRECT FIRED HEATERS



Model H—vertical unit with discharge heads 12 sizes.

Model D—vertical unit for duct work. 12 sizes.

Model P—portable, vertical unit for flexible duty. 6 sizes.

Model R—inverted unit with discharge heads at bottom. 12 sizes.

Model S—vertical unit with side blowers to permit proper location of air mixing dampers. 12 sizes.

Model C—horizontal ceiling suspension unit for space saving. 12 sizes.

Where make-up air and tempering is a problem—a National Champion heater is your answer.

And where space is a prime consideration, the National Champion Model C horizontal ceiling suspension unit is unexcelled. No matter how large or small your plant may be, there's a National Champion heater designed to do the job with the utmost economy and efficiency. All National Heaters feature the lifetime "teardrop design" stainless steel combustion chamber. National Champions come in 6 models—66 sizes, from 200,000 to 2,000,000 BTU capacities. Check these outstanding features.

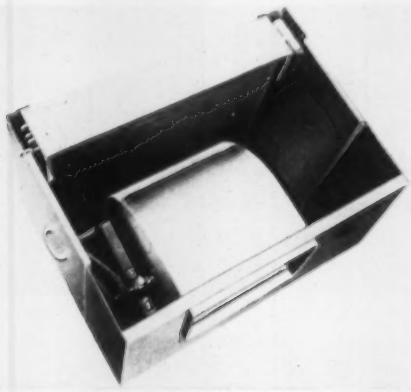
- 80% guaranteed heating efficiency
- Direct fired for gas, oil or combination fuels
- Completely automatic controls — for constant, clean heat
- 70%-150% more heat transfer area than similar units
- Quieter, smoother operation — lowest blower RPM
- Highest available external static pressures
- Electronic flame failure control
- Completely wired, assembled and flame-tested at the factory to guarantee peak performance
- Listing by Underwriters' Laboratories, Inc. and approved by American Gas Association

Write today for complete information and specifications

ASK FOR BULLETIN H

Teardrop design Combustion Chamber the heart of National Champions

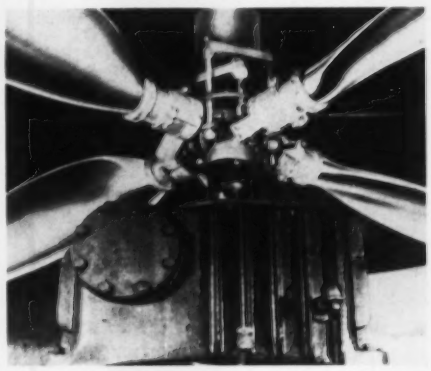
NATIONAL HEATER CO., INC.
2180 Cleora Ave. St. Paul 4, Minn.



Air Cooled Condensers . . .

. . . designed to eliminate need for water in packaged air conditioner installations—*United States Air Conditioning Corp., Dept. HPAC, 3300 Como Ave., S.E., Minneapolis 14.*

In 2, 3, 5, 7½ ton models. For commercial installations where water for refrigerant condensing is scarce or costly or waste water disposal is problem, says company. Units comprise motor, blower, condenser coil. For installation remote from packaged air conditioner.



Heat Exchanger Fan . . .

. . . featuring controllable pitch—*Hartzell Propeller Fan Co., Dept. HPAC, Piqua, Ohio.*

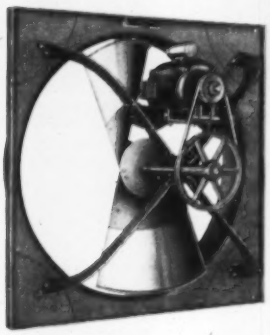
Consumes to 50 percent less power than required by conventional fixed-pitch blade fan, says company. Designed to respond quickly to conventional control equipment, increasing blade pitch to deliver more air when outlet temperature rises, decreasing blade pitch and delivering less air when outlet temperature falls.

Vibration Absorber . . .

. . . with re-useable couplings—*Packless Metal Hose Inc., Dept. HPAC, Winthrop Ave., New Rochelle, N.Y.*

Made of spirally corrugated seamless drawn tubing with re-useable couplings machined from brass. Will absorb all movement with no "whip" transmission, says company.

Tandem arrangement of Herman Nelson Fans provides convection currents that are very effective in preventing heat build-up and in maintaining employee efficiency.



- BELT AND DIRECT DRIVE MODELS
- LOW INITIAL COST
- LOW OPERATING COST
- QUIET, EFFICIENT
- OPERATE HORIZONTALLY OR VERTICALLY

Low-cost way to lick your air handling problems!

HERMAN NELSON PROPELLER FANS

Here, without question, is the way to handle *any* size installation at big savings. Choose from the widely diversified line of Herman Nelson Propeller Fans in just the right capacity for *every* ventilating need. Install them easily and at low cost. Enjoy comfortable air throughout sprawling plant or crowded office.

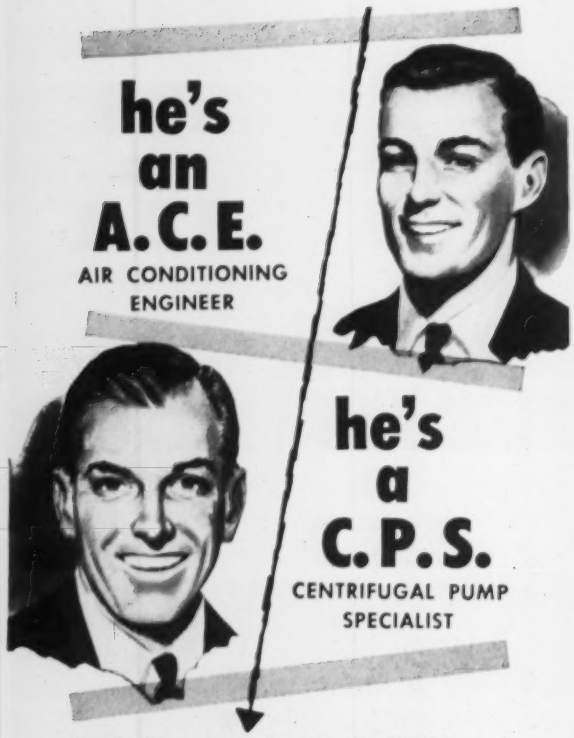
These high-powered units deliver a maximum amount of air effectively and quietly. In Belt Drive Models, you can select from capacities up to 36,150 CFM and in six sizes with wheel diameters from 24" to 54". *Small Direct Drive Models:* Designed especially for offices, stock rooms, lavatories and laboratories; 10, 12 and 14" wheels for single or 2-speed operation. *Standard Direct Drive Models:* Heavy duty units for industrial plants where contaminated air cannot penetrate the totally enclosed motor. Capacities to 12,400 CFM.

WRITE FOR BULLETIN 800. Find out how economical Herman Nelson Propeller Fans can save you money over more costly ventilating systems. Or, check your local Herman Nelson Distributor now.

AAF herman nelson

American Air Filter COMPANY, INC.

373 CENTRAL AVENUE, LOUISVILLE 8, KENTUCKY

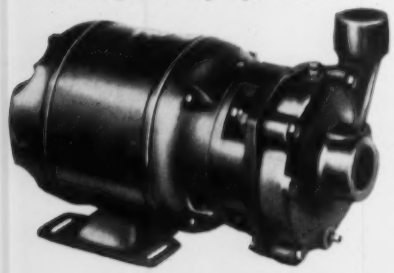


Both Experts in their fields . . . ready to aid you in YOURS!

Engineers specializing in Air Conditioning strive constantly to provide American industry with reliable climate controlled conditions that even out temperature extremes . . . providing greater efficiency through more comfortable working conditions.

Behind these capable experts, as well as others in all forms of heating and ventilating, you will find Weinman Centrifugal Pump Specialists, who wholeheartedly cooperate at all times to help solve pumping problems . . . and to supply pumps tailored to their specific needs . . . pumps that will deliver reliable, dependable continuous service.

If you're a heating and ventilating engineer, contractor or equipment manufacturer, you can eliminate your pump problems . . . permanently . . . by simply calling in an experienced Weinman Centrifugal Pump Specialist!



The WEINMAN Type AC Pump . . . mounts easily in limited space . . . in any position. Adjustable 4-way discharge facilitates location of pump and of recirculation lines. Write for Bulletin 725.

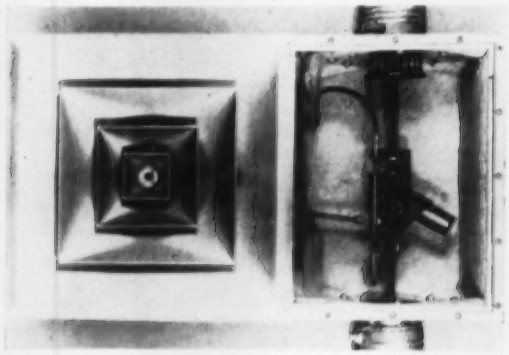
Representatives in principal cities

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

EQUIPMENT DEVELOPMENTS

Continued



Air Mixing, Diffusing Unit . . .

. . . for individual room control in hospitals, hotels, office buildings—*Anemostat Corp. of America, Dept. HPAC, 10 E. 39th St., New York 16.*

Designed to mix hot, cold air without changing volume of air supply, keeping areas at optimum comfort levels by maintaining same air flow pattern, same percentage of outdoor air. Proportional mixing valve located inside attenuator chamber controls warm, cold air supplies simultaneously, says company. Above, hot duct shown open, with cold duct closed.

Electrode Holder . . .

. . . with lightweight design—*Tweco Products Co., Dept. HPAC, Boston at Mosley, Wichita 1.*

"Twecotong" has body and upper lever of high conductivity aluminum forgings, upper and lower replaceable jaws of copper, cadmium plated to resist corrosion, company reports. Designed to increase conductivity.

Heat Exchanger . . .

. . . with superheater for use on air conditioning, refrigeration systems—*Heat-X, Inc., Dept. HPAC, 1245 Farmington Ave., West Hartford.*

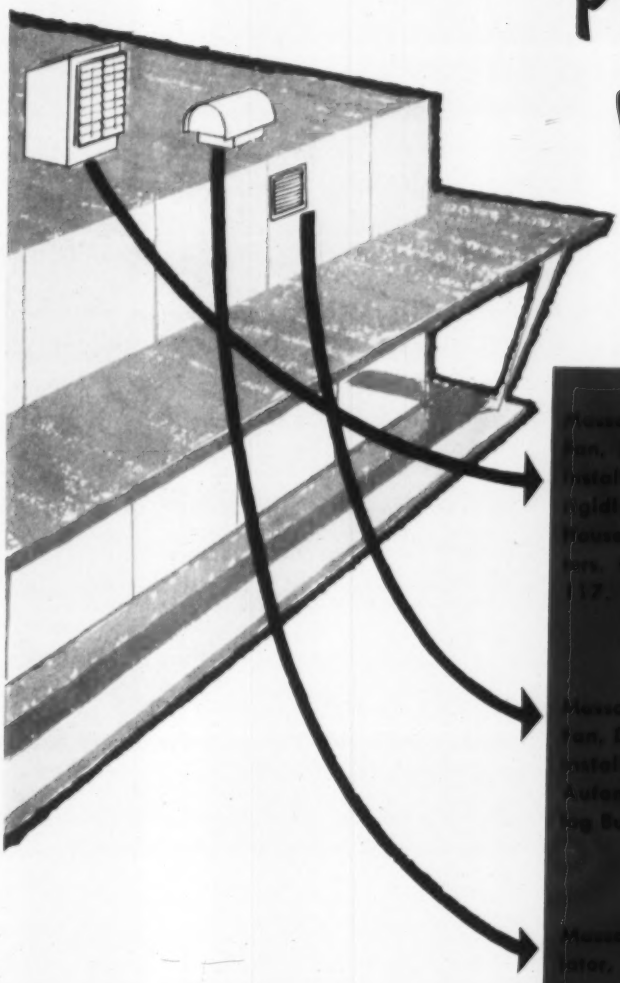
Designed to utilize evaporator surface fully, eliminate problem of having part of surface used for superheating refrigerant. Provides maximum heat transfer with minimum pressure drop, says company.

The MASSACHUSETTS Line

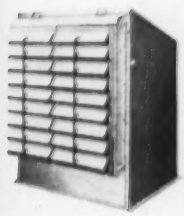
3 Types of Propeller Fan Ventilation

For Small to medium size buildings ★

Featuring Steel Venturi Type Inlet Orifice.



Massachusetts Propeller Fan, Direct or Belt Drive, installed on roof, with rigidly constructed Fan House and Automatic Shutters. Catalog Bulletin No. 117.



Massachusetts Propeller Fan, Direct or Belt Driven, installed in wall, with Automatic Shutters. Catalog Bulletin No. 117.

Massachusetts Roof Ventilator, Propeller Fan Type, Direct or Belt Driven. Catalog Bulletin No. 119.

★ For heavy duty see Bulletin No. 124 Power Fixed Roof Ventilators.

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE . . . CLEVELAND 14, OHIO

FOR WATER LINE CONTROL...

Remember

rust and scale won't clog or jam

THIS

J-E SOLENOID VALVE!

Even *dirty* water doesn't bother this J-E Solenoid Valve. There is no place for foreign matter to cause trouble . . . no metal-to-metal contact . . . just two moving parts (a stainless steel plunger and a flexible diaphragm). The flexible synthetic diaphragm literally "shrugs" off rust and scale...and is *free floating* to give you better flow with less pressure drop.

For all kinds of fluid control, J-E Solenoids *guarantee* you:

QUIET OPERATION . . . no mechanical linkage or impact action

DEPENDABILITY . . . tight seating, yet no chance for jamming or clogging

EASY MAINTENANCE . . . only two moving parts . . . cool-operating coils . . . one size coil and one plunger fit all valves

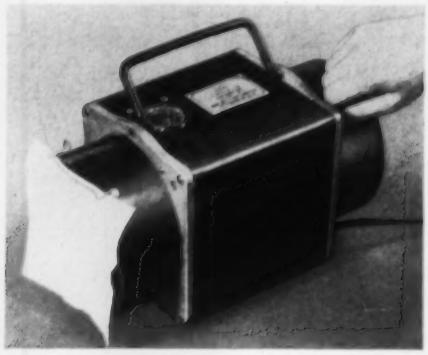
SIMPLE INSTALLATION...can be installed in any position.

CALL YOUR WHOLESALER . . .
or write us today!

J. ACKES-EVANS MANUFACTURING CO.
2527 Geraldine Avenue • St. Louis 15, Mo.

EQUIPMENT DEVELOPMENTS

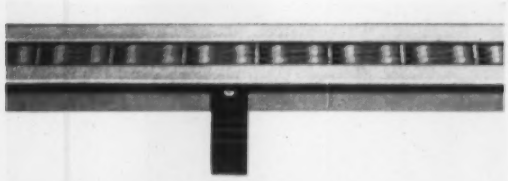
Continued



Air Sampler . . .

. . . for measuring airborne contaminants—*Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8, Pa.*

Used to collect airborne contaminants to be weighed, analyzed, in connection with industrial hygiene, air pollution problems. In ratings: 15, 30 and 50 cfm. In size 7¼ × 7¼ × 15 in. Operates from 110-volt, 60 cycle power supply, says company.



Large Window Grille . . .

. . . featuring aluminum frame with ¼ in. flange, steel or aluminum core—*Barber-Colman Co., Dept. HPAC, Rockford, Ill.*

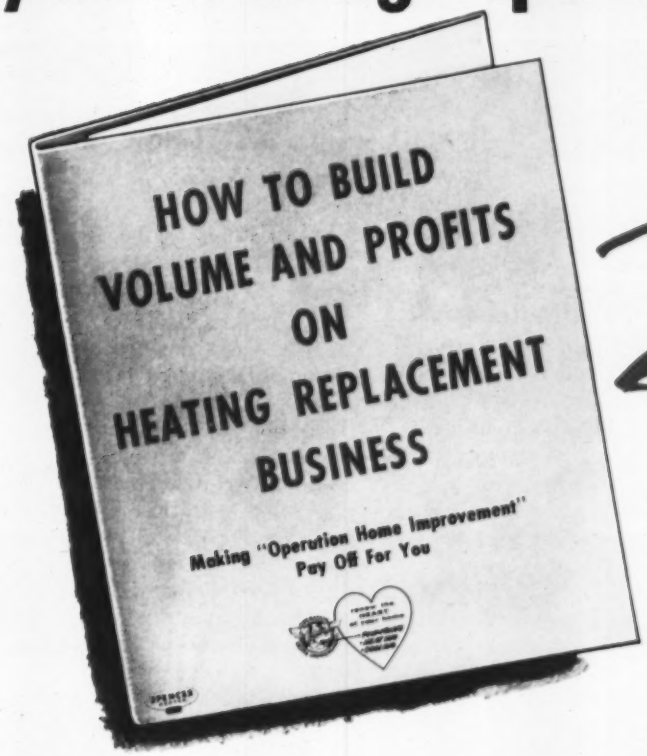
Designed to provide better air distribution in installations with large glass areas. Furnished in sections which can be butted together. Recommended by company for heating, ventilating, air conditioning school rooms, hospitals.

Capacity Booster . . .

. . . for air conditioning, refrigeration systems engineered for higher efficiencies—*Heatron, Inc., Dept. HPAC, 333 Eberts Ln., York, Pa.*

Attained through use of "Thermek" spined tubing

NOW... a plan to boost your heating replacement business this summer



FREE

Write now for this new, practical, step-by-step program that can mean increased volume and more profits *for you!*

A practical working plan

This *free* Kit takes you through each step involved in setting up a practical program—shows you how to go about getting heating plant replacement business, and more profit dollars. Included in it are some of the "tools" you'll need to get the program underway.

Answers questions like these:

1. Who are my logical prospects and how can I reach them?
2. How can I alert my own service men to replacement business possibilities?
3. What's the best way to approach my prospects?
4. How can I overcome the prospect's resistance to "having it done now"?
5. What are the two sure-fire keys to closing the sale?

MAIL THE COUPON TODAY!

There's no cost or obligation. Organize now to increase your heating replacement sales this Summer.

SPENCER HEATER

AVCO

SBI

Spencer Heater, Lycoming Div.,
Avco Mfg. Corp., Williamsport, Pa.

Gentlemen:
Please send me your *free* Kit "How to Build Volume and Profits on Heating Replacement Business."

My Name_____

Name of Company_____

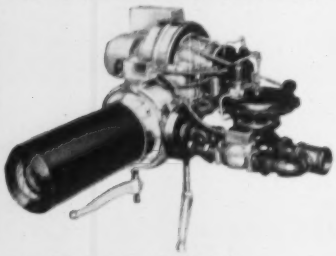
Street_____

City_____ State_____

WALNUT DAIRY FARMS

"SYNCRO-FLAME BURNER CUT OUR FUEL BILL $669.35 IN ONE MONTH"

Writes Mr. H. P. Easley, Walnut Dairy Farms, Waterloo, Iowa. "We converted a 25 HP and 30 HP boiler to Synchro-Flame Gas-Oil burner and the savings seem almost too good to be true. We cut our fuel bill in January '55 by $819.20, February by $607.38, July by $669.35."



FACTS ON SYNCRO-FLAME GAS-OIL BURNERS

- **7 Models.** 100,000 to 4,600,000 BTU's per hour on gas. 1 to 33 Gals. per hour on oil. Boiler Horsepower 2 to 100.
- **Burns any gas.** Natural, mfg., mixed and L.P.
- **Burns light oil.** Number 1 to 3.
- **Efficient.** The Syncro-Flame Combination Gas-Oil Burner is not a compromise. Automatic damper control guarantees maximum burning efficiency on either fuel.
- **Automatic or Manual.** Either manual switchover or can be set to switch over automatically from gas to oil (or reverse) at any given temperature by hook-up to an outside thermostat.
- **Easy to install.** Only 5 electrical connections necessary. Complete control panel factory wired and tested to meet any local code at no extra cost.
- **UL listed & approved.** Every Syncro-Flame Gas-Oil burner has Underwriter's Laboratories label. Also approved by State of Mass. Fire Marshal, cities of Omaha, St. Louis and Minneapolis. (N. Y. City pending.)
- **FEATURES:** Automatic Electric Ignition. Electronic Safety controls-positive automatic shut-off if flame or power go out. Patented Firing Head —prevents flame-outs and pulsation. Larger models have two stage firing and prepurge and post purge programming.

Manufacturers of U.L. Approved Gas Burners, Oil Burners and Dual-Fuel Burners ranging in capacity from 1 to 100 BHP, 100,000 to 4,600,000 BTU/hr.

FOR SPEC. SHEETS, PRICES, WRITE:

SYNCHRONOUS FLAME INC.

BOX 335-C, WALWORTH, WIS.

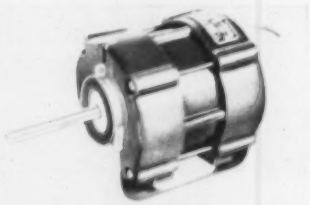
engineered excellence

DUAL GAS-OIL BURNER **syncro flame**

EQUIPMENT DEVELOPMENTS

Continued

on liquid line, says company. Inner tube, to which liquid line is connected, has been machined around and along its outer surface to produce closely packed array of spines. Heat transfer is said to be increased 1½ to 5 times over conventional finned surfaces of equal diameter.



FHp Induction Motor . . .

. . . featuring open, self ventilated frame designed for cool operation— *Howard Industries, Inc., Dept. HPAC, 1760 State St., Racine, Wis.*

Sleeve bearing unit available for pad mounting, resilient ring mounting, end mounting. In permanent split capacitor single phase, polyphase units, 50, 60, 120 cycle, rated 1/250 to 1/30 hp.

Fastening Tool . . .

. . . designed to ease light fastening work — *Olin Mathieson Chemical Corp., Dept. HPAC, 460 Park Ave., New York 22.*

"Shure-Set" ends needs for such fastening devices as toggle bolts, expansion shields, anchors, and concrete nails as well as eliminates the job of star drilling, says company. Uses variety of fasteners in ¼, 3/16 in. sizes.

COOLING WITH STEAM

C. H. WHEELER STEAM JET EJECTORS

In most cases if a process steam system is large enough for heating in winter, it can be used economically to provide air conditioning in the summer, because the increased steam load costs less per pound than the part load for process alone. A C. H. Wheeler Steam Jet Ejector system becomes most economical when air conditioning requirements exceed 100 tons. By means of this system water is chilled to as low as 50-55°F. with steam pressure of 50 psi or over. C. H. Wheeler has always led in the development of the steam jet ejector and its application to industrial refrigerating requirements. We invite your correspondence.

(Catalog 1462 is available.)

Note: In many areas utilities offer an attractive street steam rate in summer, which makes the steam jet ejector system economical for air conditioning large commercial and public buildings.

WE-509

C. H. Wheeler of Philadelphia

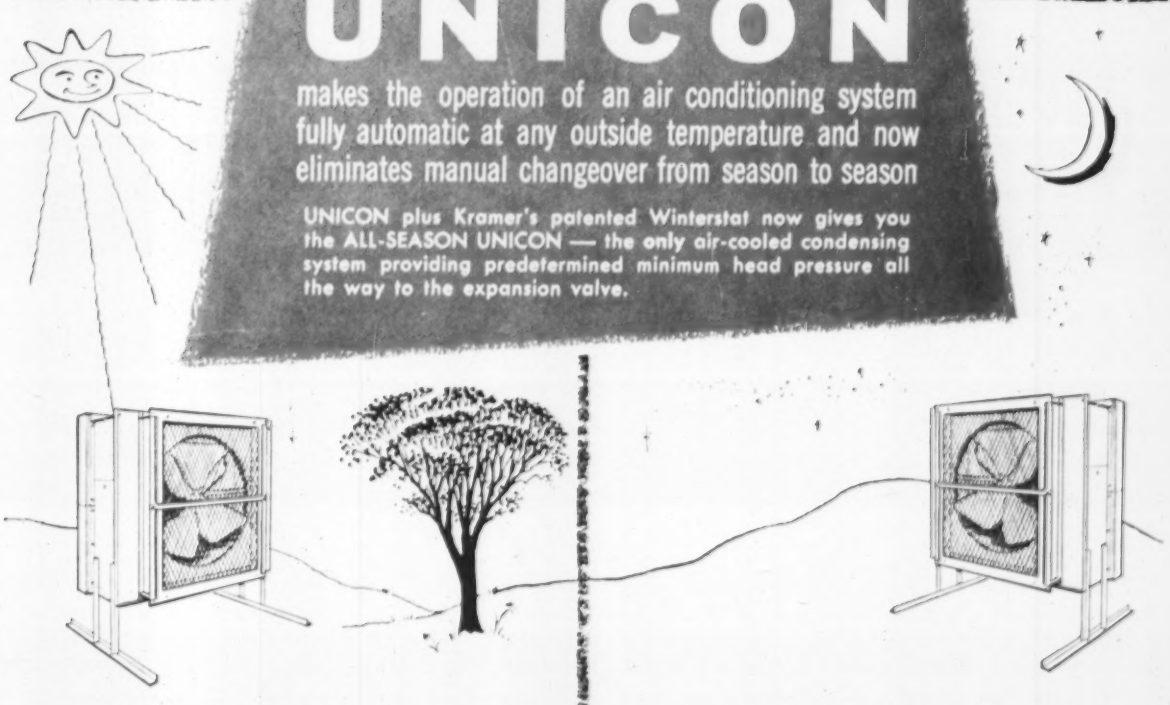
19TH AND LEHIGH AVE., PHILADELPHIA 32, PA.

whether it's Summer . . . Winter

The ALL-SEASON
WINTERSTAT
with the KRAMER
UNICON

makes the operation of an air conditioning system fully automatic at any outside temperature and now eliminates manual changeover from season to season

UNICON plus Kramer's patented Winterstat now gives you the ALL-SEASON UNICON — the only air-cooled condensing system providing predetermined minimum head pressure all the way to the expansion valve.



High Noon. . . or cool of evening

KRAMER TRENTON CO. • Trenton 5, N.J.

BRANCH
after
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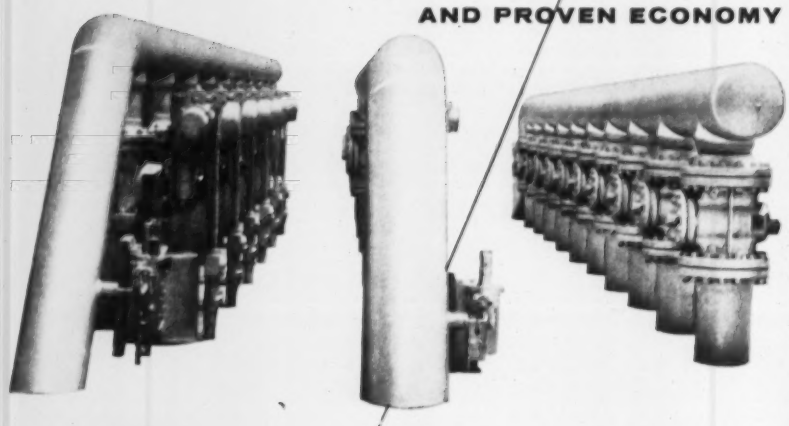
after
BRANCH
after
BRANCH
after
BRANCH

WELDOLETS

FOR ASSURED STRENGTH

AND PROVEN ECONOMY



WELDOLETS

THREDOLETS

SOCKOLETS

BONNEY

Are you effecting this economy for your company? Neat and uniform appearance is evident in code constructed weldolet headers in this crude oil pipeline terminal. The money saved is in the bank and does not appear in this picture. If you are not using the weldolet method of cutting piping costs, write today for information.

SOLD THROUGH LEADING DISTRIBUTORS

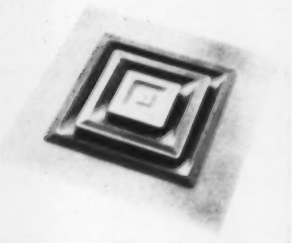
WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

715 MEADOW ST., ALLENTOWN, PENNA.

EQUIPMENT DEVELOPMENTS

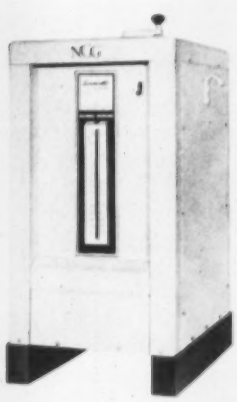
Continued



Diffuser . . .

. . . for use where air is to be both discharged, returned through single unit—*Connor Engineering Corp., Dept. HPAC, Danbury, Conn.*

Units geometrically proportional throughout all sizes. At constant neck velocities, static pressure is said not to vary, assuring uniform diffusion patterns over large area, says company. Air discharge through outer and middle cones. Return air drawn through center section.



Arc Welders . . .

. . . in expanded line including 10 different types, 93 models—*National Cylinder Gas Co., Dept. HPAC, 340 N. Michigan Ave., Chicago 11.*

"Sureweld" line available in a-c, d-c rectifier, a-c inert arc, combination a-c/d-c, portable engine driven d-c units.

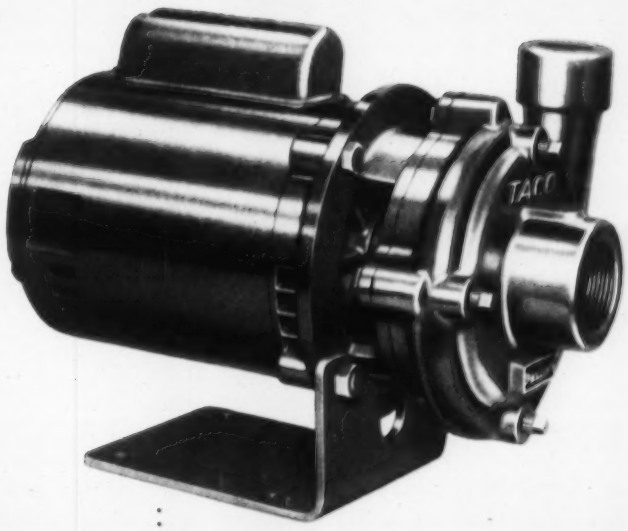
Explosionproof Motors . . .

. . . in line through NEMA frames 405 and 215—*Sterling Electric Motors, Inc., Dept. HPAC, 5401 Telegraph Rd., Los Angeles 22.*

For use in hazardous locations. Specially treated to resist moisture,

NEW FROM TACO

SERIES 170 CENTRIFUGAL PUMP FOR AIR CONDITIONING INSTALLATIONS



Experience, research, quality control production . . . standard with Taco in the long-time manufacture of domestic hot water heating circulators . . . are the basic reasons why the new 170 series pumps fully meet the precise requirements for all installations. Note the following features that assure peak performance:

MOTOR — Motors regularly furnished are 3450 R.P.M., 60C, Single Phase, with permanently sealed ball bearings. Motors with other characteristics available.

MECHANICAL SEALS — 2 piece type for easy replacement; self-adjusting, self-lubricating.

IMPELLER — Closed type. Balance for smooth, noiseless, efficient operation.

VOLUTE — Fine-grained cast iron with brass wearing ring. Designed for four position discharge.

MOUNTING — Heavy stamped steel base — yet flexible enough to permit slightly out of line connections without damage to pump or noisy operation.

LUBRICATION — None required.

The Taco 170 series is light in weight, low in cost, extremely compact, available in several sizes . . . it's the pump that performs best.

Call or write today for complete information.

BETTER HEATING — Taco — BETTER WITH TACO

TACO HEATERS, INCORPORATED

1160 Cranston Street, Cranston 9, R. I.

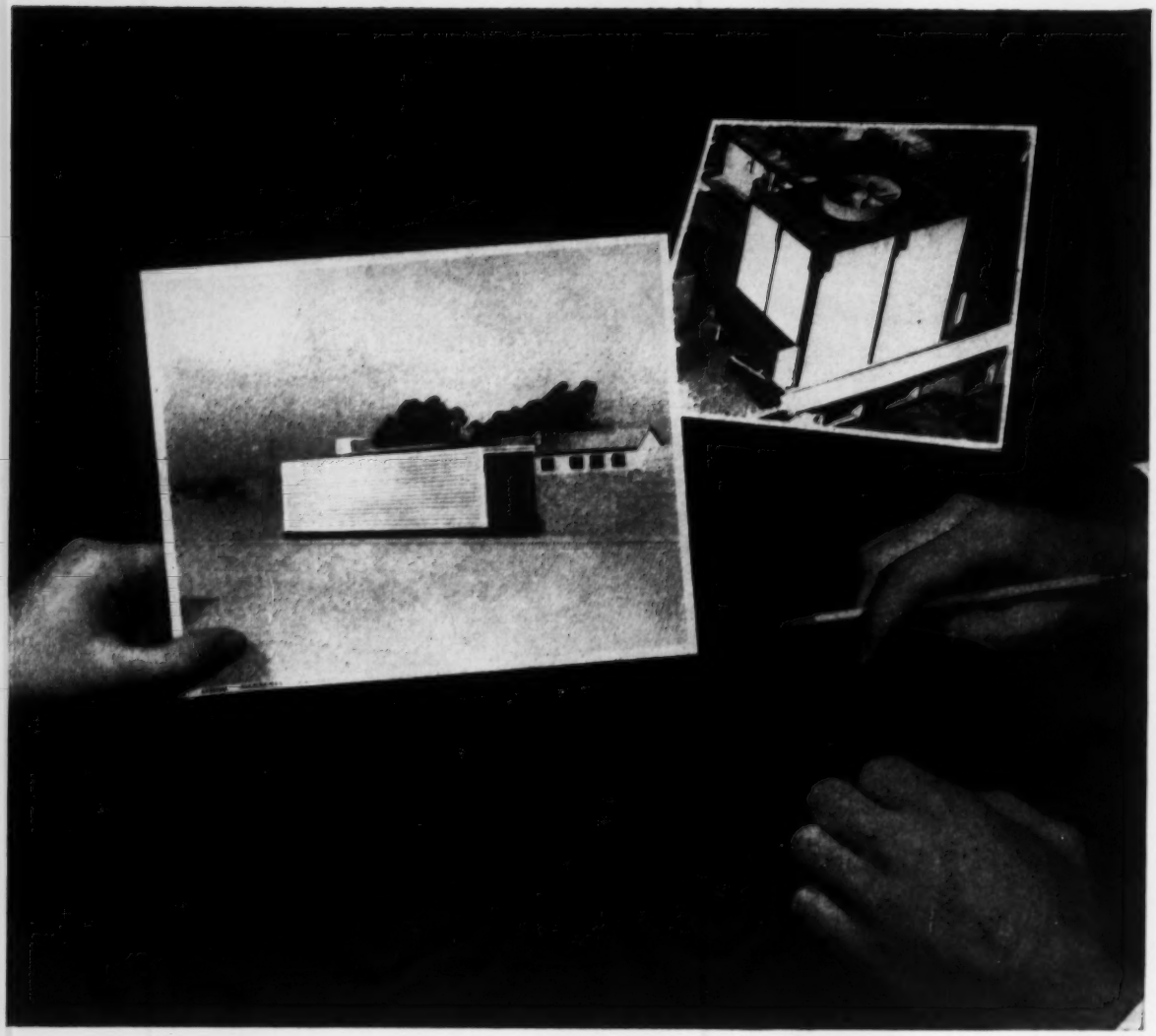
342 Madison Ave., N. Y. 17, N. Y.

4 Gilead Place, Toronto 2, Can.

Send No. 170 Pump Technical Data Sheet to:

Name

Address



"There's just no comparison! This Pritchard LoLine answers our design problem!"

"When you said it had a low silhouette, you really meant *low!*"

"That's why we chose this Pritchard LoLine tower. You know, cooling towers have always been a problem to architects. We design a good looking building and then have to clutter up the design by putting a tall and unsightly tower on top of it."

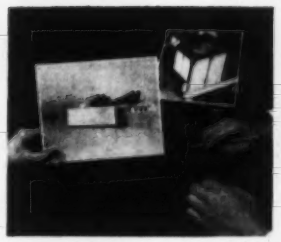
"Well, this LoLine ought to make you fellows happy!"

"It makes everyone happy. The engineers like it because it's efficient, has an internal piping system and a performance record that can't be beat. The owners of the building are happy because of the low initial costs and the minimum maintenance."

"It looks like the Pritchard LoLine is the answer to a lot of cooling tower problems."

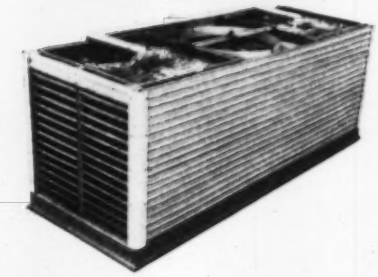
"It is! Whenever there's a problem, you can always count on Pritchard to come up with an answer!"

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.



"There's just no comparison! This Pritchard LoLine answers our design problem!"

Seven good reasons for choosing the LOLINE®



Pritchard LoLine Cooling Towers are better in seven important ways:

1. They have the lowest silhouette of any tower 75 tons and up. Over-all height is just 7' 7 11/16".
2. *Galvanized* steel fan drive supports and basin accessories; not cheap, less durable, painted steel.
3. Grease fittings for the V-belt drive bearings are brought to the outside of the tower. Greater safety, easier maintenance.
4. *Corrugated* asbestos cement board casing; not flat asbestos cement board sheets.
5. Asbestos cement board louvers are installed as standard, not special equipment.
6. Optional internal pipe supply system. Permits complete concealment of piping.
7. V-belt drive features a stainless steel fan shaft for far longer life.

WRITE FOR LOLINE BULLETIN

Send for bulletin No. 5.1.902. Tells you all about the framework and mechanical equipment, capacities, optional equipment, name and address of Pritchard sales office nearest you. Write for your complimentary copy today on your company letterhead!

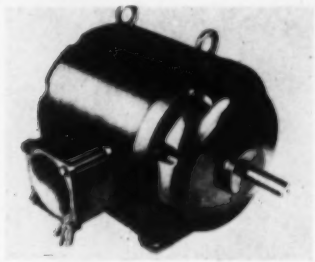
INDUSTRY'S PARTNER FOR PROGRESS

J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 509, 4625 Roanoke Parkway
Kansas City 12, Mo.

COOLING TOWERS * GAS & AIR TREATING EQUIPMENT
REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

EQUIPMENT DEVELOPMENTS

Continued

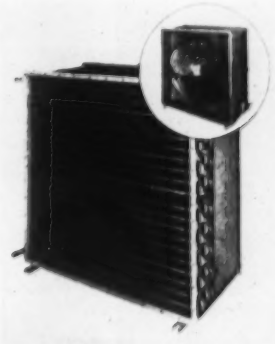


dust, corrosive atmospheres, says company. Cited features are extra long flame paths at shaft and bracket fits, sealed and prelubricated ball bearings. In standard, geared, variable speed models.

Flexible Tubing . . .

. . . for hot water heating systems—*Packless Metal Hose, Inc., Dept. HPAC, 31-12 Winthrop Ave., New Rochelle, N. Y.*

"Flexline" engineered to control expansion, absorb vibration, deaden noise and prevent pipe leakage in hot water heat systems. Machined fittings attached with high temperature brazing material allows connectors to be used for high temperature steam applications also, says company.

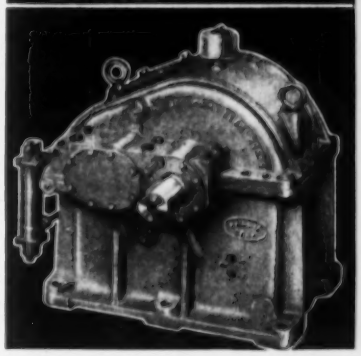


Air Cooled Condensers . . .

. . . with reversed air flow—*Larkin Coils, Inc., Dept. HPAC, 519 Memorial Dr., S. E., Atlanta 1.*

Air now pulled instead of pushed

for INDUSTRIAL *and* AIR CONDITIONING SERVICE . . .



Phillie Gear *standardized*
HI-SPEED REDUCER / INCREASER

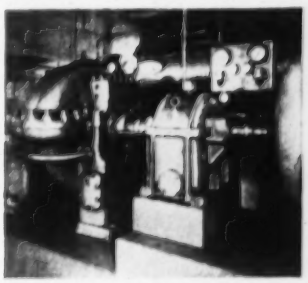
These modern, ruggedly-built Standardized Units contain all the features and advantages of custom-built units; being specially designed for *increaser or reducer applications*—where rotating speeds range as high as 9000 r.p.m., or pitch line velocities up to 10,000 feet per minute.

Phillie Gear Hi-Speed Units meet the current trend toward higher prime-mover speeds of steam turbines, ultra high speed electric motors, or internal combustion engines—for driving Compressors, Pumps, etc. at *reduced speeds*, or the *increased speed* required for driving many Pumps, Compressors, Fans and Generators.

All helical gears and shafts are dynamically balanced to give the ultimate in vibration-free power transmission.

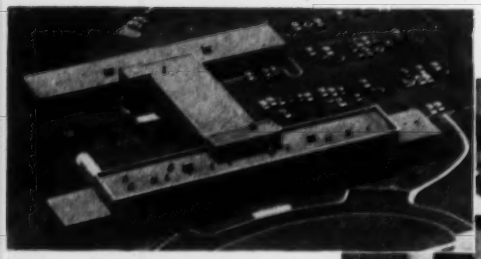
These Hi-Speed Units are available for horsepowers from 1 to 7,100; ratios 1:1 to 10:1, for either speed increasing or speed reducing.

Send for Catalog HI-55.

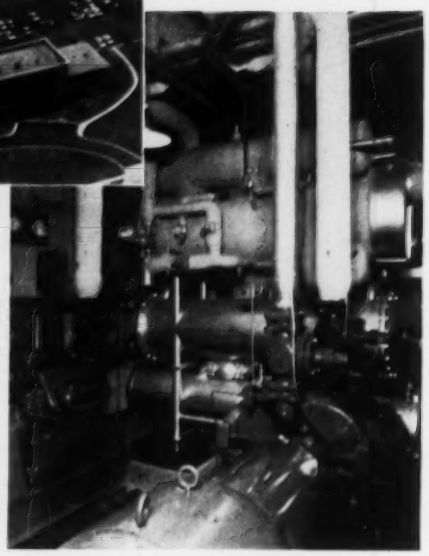


A Phillie Gear HI-SPEED Air Conditioning Drive Installation, Sears Roebuck Co., Pittsburgh, Pa. Input 342 HP with 1.3.56 Increase, Output speed 6250 RPM

phillie gear
PHILADELPHIA GEAR WORKS, INC.
INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS - FLEXIBLE COUPLINGS



Midwest Research Institute, Kansas City, Missouri equipped with a Vilter central station air-conditioning system.



Two Vilter 6-cylinder VMC Freon-12 compressors, and a Vilter shell and tube cooler.

Q. *Why is Vilter Air Conditioning so well accepted in the Building Industry?*

A. **because Vilter equipment lasts longer—and costs less to own***

Vilter performance starts with a soundly engineered system designed to your specific needs, careful installation, and on-the-job testing.

Note how carefully this Midwest Research Institute job was laid out: The installation consists of two Vilter 6-cylinder VMC Freon-12 compressors, direct-connected to two 60 hp, 1160 rpm motors. Each compressor has a capacity of 60 tons, making a total of 120 tons when cooling 360 gpm of chill water from 52° to 44°. The Vilter shell and tube flooded cooler is mounted on a stand in conjunction with the Freon condenser, liquid receiver, and heat exchanger. Each compressor is operated at ⅓, ⅔, or full capacity as the load requires . . . the system is completely automatic through the six-stage step controller . . . equipped with complete safety control system.

This system has operated entirely satisfactorily and the owners are well pleased. Call your Vilter representative about your problem.

Equipment furnished by O'Dower Engineering Co., Kansas City; Installed by A. D. Jacobson Plumbing and Heating Co., Kansas City; Designed by: Howarth, Scott and Kinney, mechanical engineers.

* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low cost ownership.

QUALITY CRAFTSMANSHIP that lasts . . .

ENGINEERING DESIGN that guarantees performance

Vilter®

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

EQUIPMENT DEVELOPMENTS

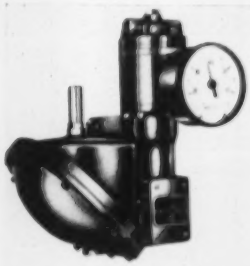
Continued

through unit to make possible better distribution of air, hold noise to minimum, make removal of lint and leaves simple, says company. Available in 2, 3, 5, 8 and 10 ton units engineered for parallel use.

Time Switch . . .

. . . with shearing action of contacts—*General Electric, Dept. HPAC, Schenectady 5.*

Designed to turn electric circuits on or off at any time. Used to control capacitor switches, heating, air conditioning and refrigeration equipment, irrigation and pump devices, says company. Features unique shearing action of contacts which are forced to slide against each other as they open and close. Operating voltage of the "TSA-40" is 120, 240 and 480 volts a-c; frequency, 60, 50, and 25 cycles.

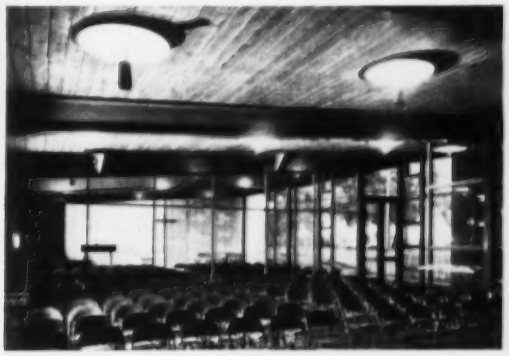


Pressure Transmitter . . .

. . . designed to measure pressure as low as 0 to 5 mm mercury absolute—*Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

For handling pressure ranges from 0-5 mm Hg to 0-760 mm Hg., transmits universal 3-15 psi pneumatic signal, says company. Can be used with any standard pneumatic receiver, automatic controller.

"Little brown church in the vale" ...*modern version*



Heated radiantly with Steel Pipe

For this widely publicized community church, built for a total of only $67,000, steel pipe radiant panel heating fitted the budget and the heating requirements perfectly.

The simple beauty and dignity of an interior unmarred by exposed heating elements, and the all-purpose flexibility made possible by sliding walls, governed the selection of "invisible" radiant heating. The known economy and durability of steel pipe for heating made *it* first choice.

Yes, steel pipe has been proved in more than 60 years of hot water and steam heating applications. It still is the most widely used pipe in the world for radiant heating, snow melting, plumbing, fire sprinkler systems, structural applications, air, gas and water lines!

Write for the free 48-page color booklet, "Radiant Panel Heating with Steel Pipe."

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 FIFTH AVENUE, NEW YORK 1, N.Y.

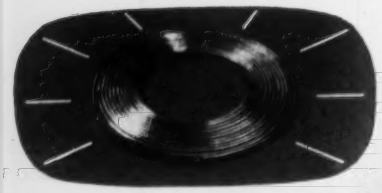
Steel Pipe is First Choice

Seamless
UNITED ALUMINUM TUBE

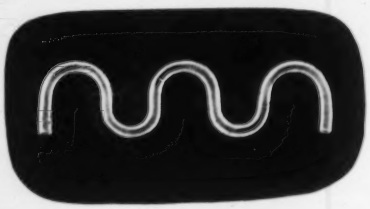
...all the features you want

at a low cost per foot!

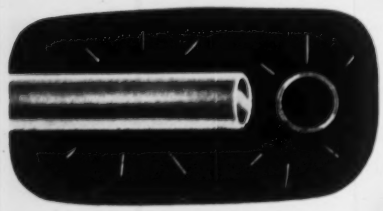
Here's what you get when you specify and buy quality-controlled United Aluminum Tube:



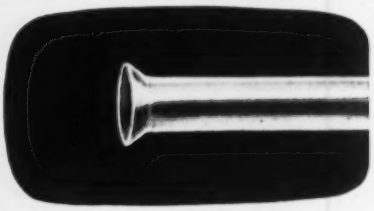
EXTRA-GOOD, commercially bright, clean surface.



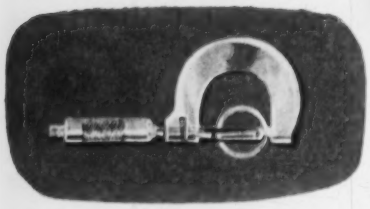
UNIFORMITY OF TEMPER
(the best in "bendability")



CLEANLINESS — inside and outside, with square ends "commercially free from burrs."



EASILY FLARED without cracking or splitting.



CLOSER TOLERANCES that give you more footage of United Aluminum Tube per pound, and earn you a lower cost per foot!

Add to these, speed of delivery, no charge for cut-to-length from 36" up and you'll agree with the host of appliance manufacturers who specify and buy United . . . the quality name in aluminum tube.

Permanently United

UNITED WIRE
AND SUPPLY CORPORATION

PROVIDENCE 7, R. I. • OFFICES IN PRINCIPAL CITIES

LOOK TO UNITED FOR THE BEST IN ALUMINUM, COPPER AND BRASS TUBE AND WIRE

EQUIPMENT DEVELOPMENTS

Continued

Submersible Pump . . .

. . . in two new models—*Lancaster Pump and Mfg. Co., Dept. HPAC, Manheim Rd., Lancaster, Pa.*

One "Drain-Pak" all bronze; other cast iron cadmium plated, bronze fitted. Equipped with 1/3 hp, 60 cycle, 110 volt motor with overload protection. For use wherever totally submerged sump pump required, says company.

Portable Power Drive . . .

. . . equipped with automatic clutch—*Oster Mfg. Co., Dept. HPAC, Box 1326, Cleveland 32.*

Available equipped with gasoline, electric, or air power drives. Has aluminum alloy frame, folding tripod. Designed to handle pipe 1/8 to 2 in. in diameter.

Detecting Instrument . . .

. . . designed to measure hydrogen sulphide concentrations—*Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8.*

Features dual scale said to pro-

looking for service with your stainless steel pipe?

CALL YOUR REPUBLIC ELECTRUNITE DISTRIBUTOR

He's as near as your telephone. And whatever your requirements, he'll ship the sizes you need in the analyses the job calls for.

For positive identification before using, you'll find every length of Republic ELECTRUNITE® Stainless Steel Pipe and Tubing from distributor's stock clearly stenciled the full length with the type, heat number and specification. This makes it easy to identify, no matter where it's cut.

And it doesn't matter how the pipe or tubing has to be joined. Republic ELECTRUNITE Stainless Steel Pipe can be welded, threaded or used with compression fittings.

You can get Republic ELECTRUNITE Stainless Steel Pipe in types 304, 304L, 316, 316L, 321 and 347—plus other analyses. Continuous welded sizes from ⅛" I.P.S. through 2" I.P.S. in A.S.A. schedule 40S; from ⅛" I.P.S. through 4" I.P.S. in schedule 10S; and from ½" I.P.S. through 4" I.P.S. in schedule 5S wall thicknesses. Larger sizes up to 30" also available. Republic Stainless Steel Tubing is also available in a complete range of sizes and analyses.

Call your Republic ELECTRUNITE Distributor and give him a chance to demonstrate his service facilities. He deals only in quality stainless steel pipe and tubing—and he's eager to serve you.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION

ALABAMA
Industrial Piping Supply Co., Bessemer

CALIFORNIA
Ducommun Metals and Supply Co., Los Angeles
Earle M. Jorgensen Co., Oakland

CONNECTICUT
Peter A. Frasse and Co., Inc., Hartford

GEORGIA
Atlantic Steel Company, Atlanta

ILLINOIS
Chicago Steel Service Co., Chicago
Chicago Tube and Iron Co., Chicago
Creamery Package Co., Chicago

KENTUCKY
Williams and Company, Inc., Louisville

MARYLAND
Hill-Chase Steel Co. of Maryland, Baltimore

MASSACHUSETTS
Springfield Plumbing Supply Co., Springfield

MICHIGAN
Kenneth Anderson Company, Detroit

MISSOURI
Marsh Steel Corp., North Kansas City

NEW JERSEY
A. B. Murray Co., Inc., Elizabeth

NEW YORK
W. A. Case & Son Co., Inc., Buffalo
Peter A. Frasse and Co., Inc., Buffalo
Peter A. Frasse and Co., Inc., Syracuse
Peter A. Frasse and Co., Inc., New York
K. & S. Metal Supply, Inc., Long Island City

OHIO
Williams and Co., Inc., Cincinnati
Williams and Co., Inc., Cleveland
Williams and Co., Inc., Columbus
Williams and Co., Inc., Toledo

PENNSYLVANIA
Peter A. Frasse and Co., Inc., Philadelphia
Hill-Chase and Co., Philadelphia
Williams and Co., Pittsburgh

TENNESSEE
Metals, Inc., Bristol
Vance Iron and Steel Co., Chattanooga

TEXAS
The Baldwin Co., Houston

VIRGINIA
John Frishchkorn, Richmond
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World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
228 East 131st Street, Cleveland 8, Ohio

Please send me information on Stainless Steel Pipe and Tubing.

Name_____

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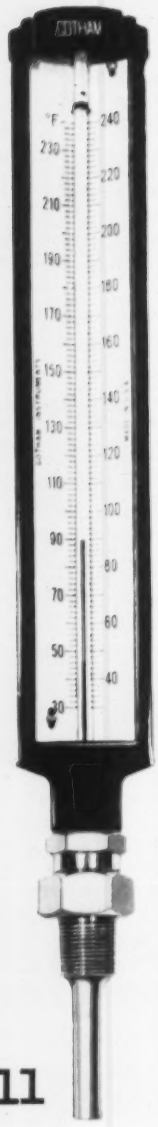
What are your requirements in industrial thermometers?

- Easy Reading?
- Accuracy?
- Sensitivity?
- Flexibility?
- Ruggedness?



USG GOTHAM assures them all

The Red-Reading Mercury tube is today a standard for easy-to-read Industrial Thermometers.

USG Gotham Thermometers are built to withstand long, hard usage and maintain maximum accuracy and sensitivity.

They are available for straight mounting, 90° back or side angle, incline or recline and multi-angle mounting. Separate sockets and other accessories can also be furnished when specifications require.

Investigate the Gotham line before you specify. Write for Catalog No. 101.

UNITED STATES GAUGE

Division of American Machine and Metals, Inc.
Sellersville, Pa.

Home of the **SUPERGAUGE**

EQUIPMENT DEVELOPMENTS

Continued

vide accurate readings in percentages by volume or in grains per hundred cu ft. Detects hydrogen sulphide concentrations as low as .0025 percent, up to .04 percent by volume, says company.

Steam Trap . . .

. . . engineered with only one operating part. *Sarco Co., Inc., Dept. HPAC, Empire State Bldg., New York 1.*

Solid, hardened stainless steel disc only moving part. In 3/8 in. size, recommended for tracer line application, says company. Available in 1/2, 3/4 and 1 in. sizes, also. Same trap without changes for 10 to 600 psi.

Test Plug Kit . . .

. . . for use in temporarily shutting off 1/2, 3/8, 7/8 OD tubing. *Imperial Brass Mfg. Co., Dept. HPAC, 1200 W. Harrison St., Chicago 7.*

Three plugs packaged in plastic box with hinged lid. For pressures to 100 psi. Can be used on liquid or gas lines, except those carrying materials that would deteriorate synthetic rubber.

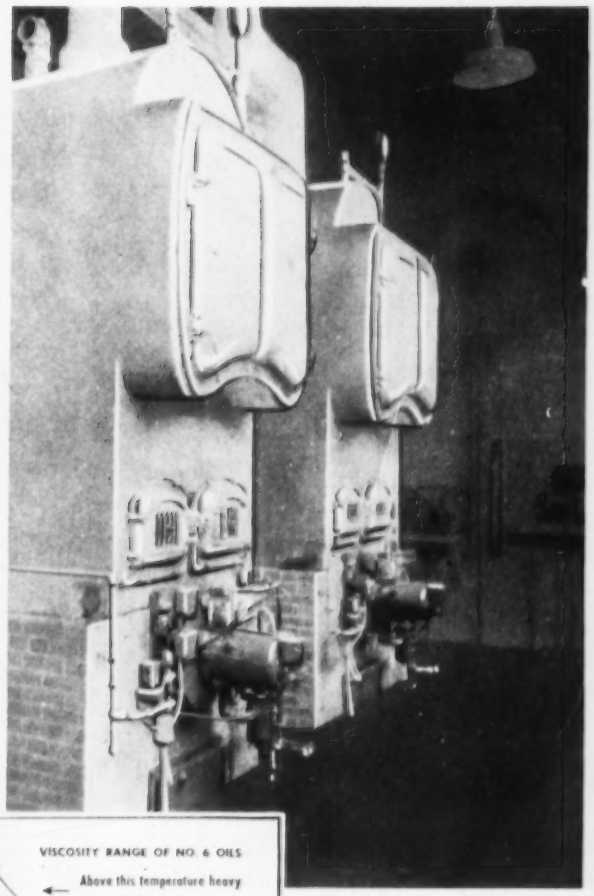
Drive System . . .

. . . of synchronized variable speed, multiple drives. *U. S. Electrical Motors Inc., Dept. HPAC, Box 2058, Terminal Annex, Los Angeles 54.*

Heart of system is specially designed "Varidyne" power unit interlocking motors by means of electrical impulses, says company. Can be furnished from 1/3 to 25 hp at maximum rpm. Is of a-c, squirrel-cage induction type.

DEPENDABILITY

the one thing in heating you dare not overlook



Heating plant in the Midvale School, Madison, Wis. The two Petro rotary oil burners are equipped for automatic modulating flame control.

Petro rotary oil burners are dependable because of their simple design and sound, rugged construction

Sluggish heavy oil (No. 6) is easily controlled by a system that is remarkably free from mechanical "gimmicks." It's like this:

1. A simple oil heater automatically warms the oil to a point where viscosity is constant. (See chart.)
2. A magnetic valve passes the oil to the nozzle when it is warm enough for accurate metering and instant ignition.

That is the basic idea of the Petro Thermal Viscosity Principle. It isn't fancy; it isn't temperamental; but it STAYS ON THE JOB. Petro owners need not be impressed by metering pumps, viscosity compensating valves, or other complicated mechanisms found in many burners.

All this and fuel economy too

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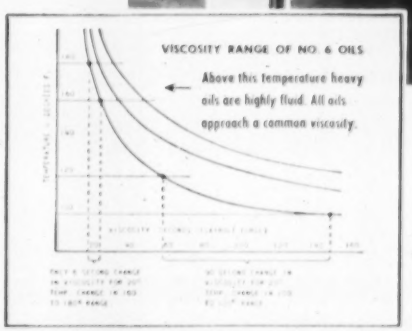
For further information use the accompanying coupon, or look in the yellow telephone directory pages under Oil Burners for name of your Petro dealer.



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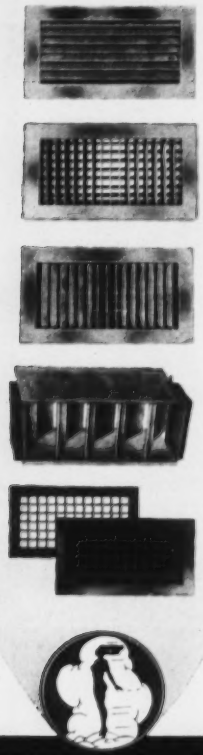

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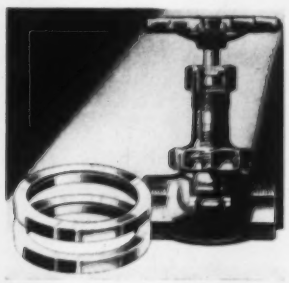
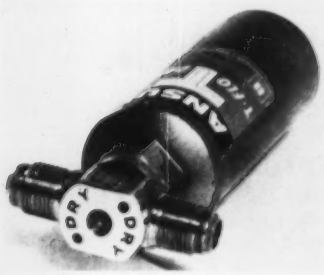


Bronze Globe Valves . . .

. . . rated 200 psi steam; 400 psi water, oil, gas—*Lunkenheimer Co., Dept. HPAC, Box 360, Cincinnati 14.*

"LQ600-200" line designed to answer need for higher pressure, throttling globe valve, says company. Are said to have high wear, corrosion resistance. Cited features are new alloy seating metal, flat seat design.



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. . . a new gel-type activated alumina *Ansul Chemical Co., Dept. HPAC, Marinette, Wis.*

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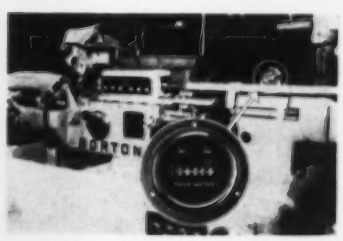

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. . . designed for 120, 240, 480 volts *John W. Hobbs Corp., Div. of*

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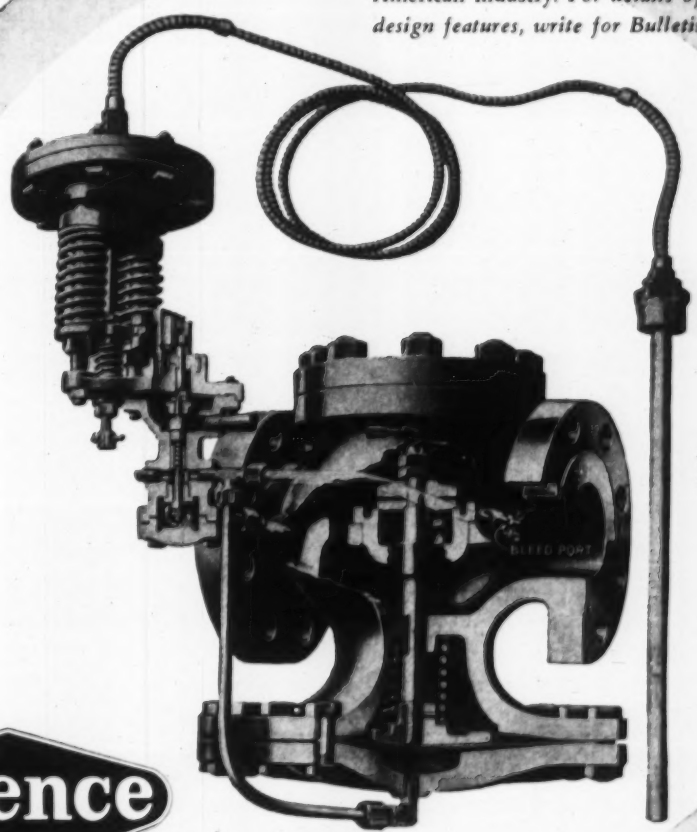

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EQUIPMENT DEVELOPMENTS

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Available in 10,000 (showing 1/10 hr), 100,000 hr models. In 24, 50 and 60 cycles. For application in air conditioning units, pumps, refrigeration units.

Gas Fired Unit Heaters . . .

. . . designed for new enclosure styling, advanced burner and heat exchanger design—*Modine Mfg. Co., Dept. HPAC, 1509 De Koven Ave., Racine, Wis.*

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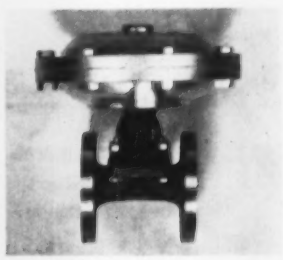

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. . . with springless motor—*Uniflow Valve Corp., Dept. HPAC, 19 Quine St., Cranford, N. J.*

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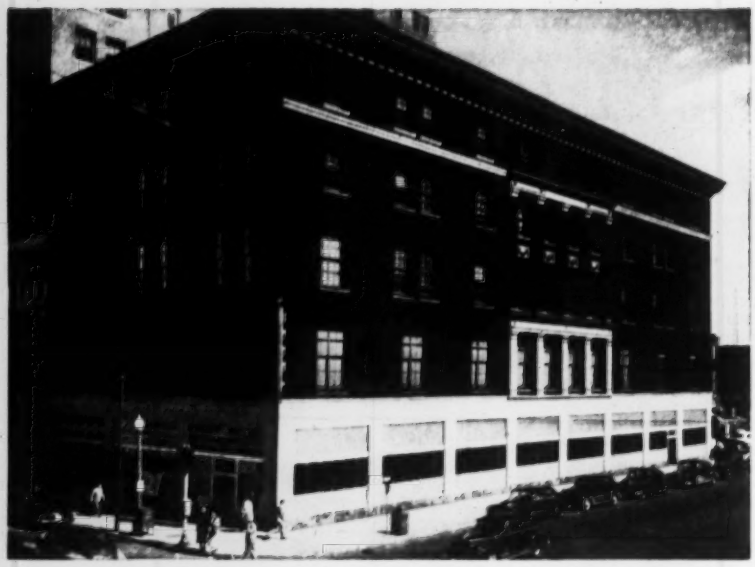

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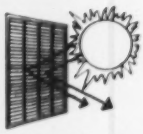

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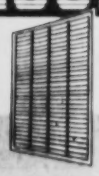

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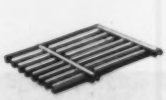

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Units burn No. 1 to No. 3 fuel oil. Recommended by company for fire tube, water tube boilers. Are said to have high CO_2, low smoke factors. Utilize forced draft, electronic safety controls, firing head designed to eliminate pulsation.

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. . . engineered to facilitate fuel economy for sectional, vertical boilers—*Preheater Corp. of America, Dept. HPAC, 115 Lexington Ave., New York 17.*

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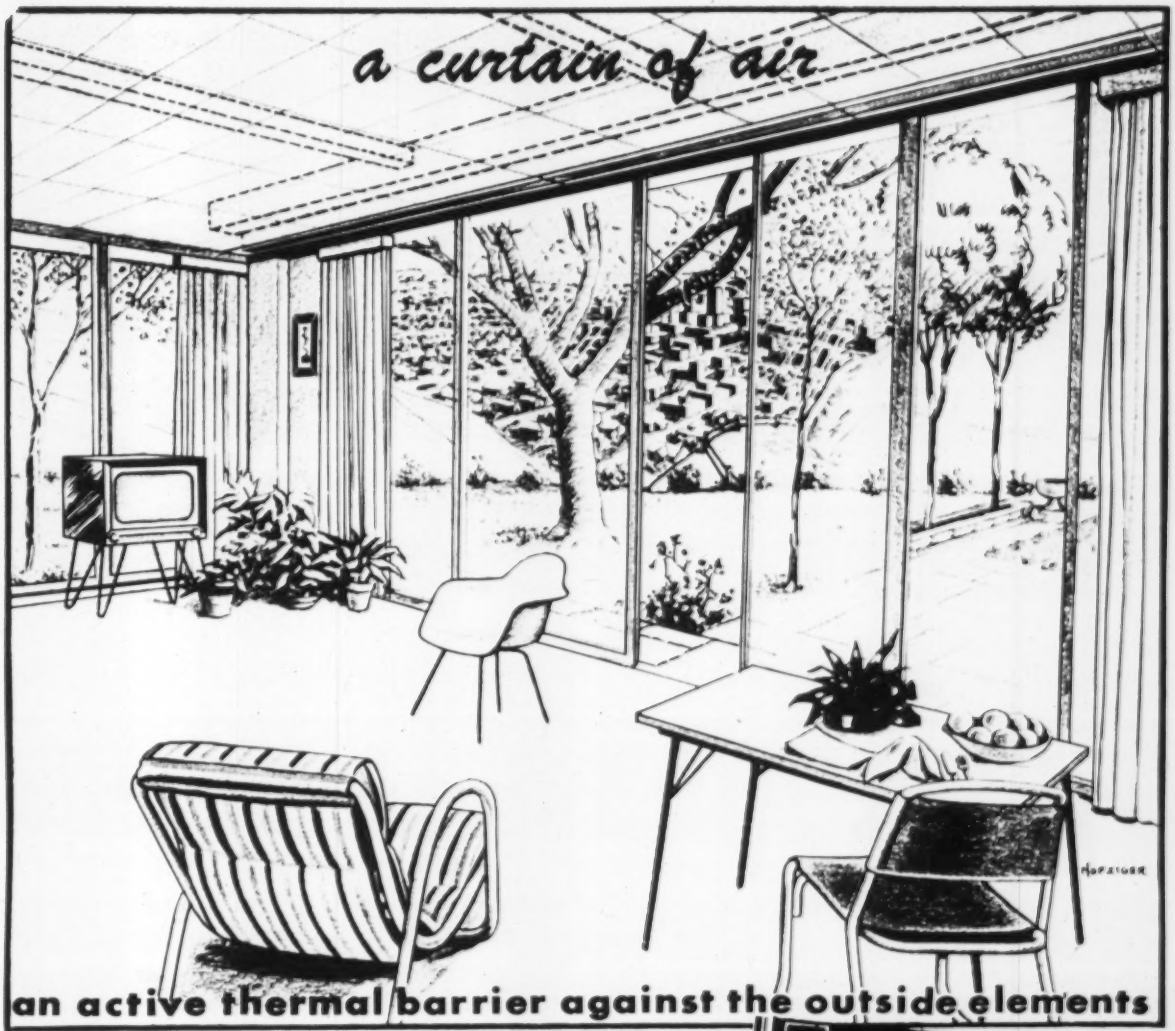

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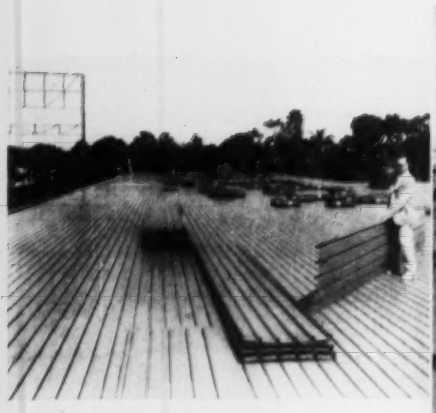
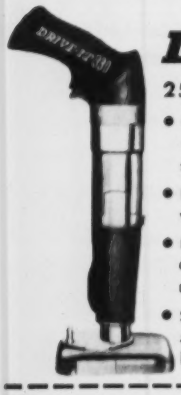


J. S. Stephens and Sons, Tampa, Florida contractors, used DRIVE-IT tools to speed the installation of the steel decking used as the roof of the Dunedin Shopping Center. Mr. Stephens used two model 330 DRIVE-IT tools to drive over 4,000 drivepins to anchor the steel decking to the steel roof trusses. Installations of this type average about 75% savings over drilling and other outmoded fastening methods. If you fasten *anything* to concrete or steel—you can save with *DRIVE-IT* tools.



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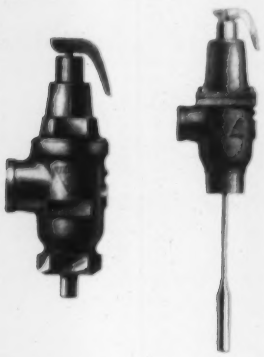
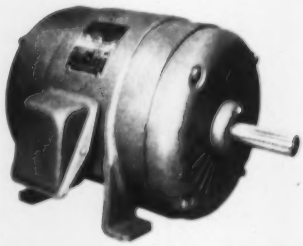


Relief Valves . . .

. . . now available as ASME temperature, pressure relief units—*Watts Regulator Co., Dept. HPAC, Lawrence, Mass.*

Automatic self-closing type valves rated in accordance with ASME and National Board of Boiler and Pressure Vessel Inspectors, says company. Available in two series with steam discharge capacities to 1,732,000 Btu per hr.



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. . . with extruded plastic insulation *Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland 17.*

In standard sizes 1 to 40 hp. Present line built in open type frame, torque design B. Insulation, molded into and around windings, is said to have high resistance to chemical action, humidity, abrasive dust, lime, oil vapor. ‡

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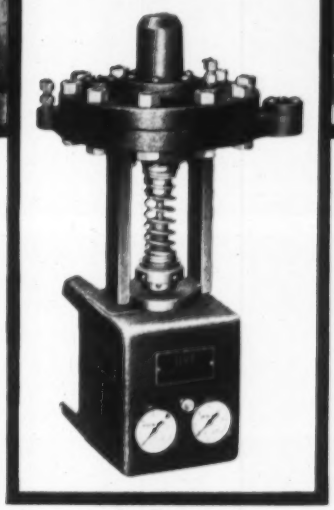

Leslie Type LA-2
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EXTRACTION TYPE FEEDWATER HEATER DRAIN CONTROL
This Leslie liquid level controller is installed in heater drain service in a Midwest utility station. You will also find Leslie liquid level controllers in condenser hot well service, de-aereating heater installations and boiler level control.

Leslie Floatless Level Control Pilots sense changes in liquid level that will help you maintain peak output. You save maintenance dollars, too — forget troublesome floats and cages (there aren't any).

With low resolution sensitivity (.1 of an inch change in level creates response), you are assured of smooth, throttling action and a closely held level.

There are Leslie Pressure Control and Temperature Pilots with the sense to save dollars in pressure and temperature control stations, too. Your Leslie Engineer, listed under "Valves or Regulators" in your classified directory, will be glad to help you.

Send for Bulletin 5303 on Leslie Control Pilots

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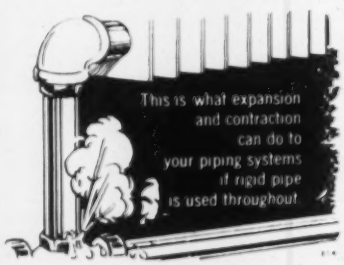
Call or write now for special technical bulletins or further detailed information. Please give us a general idea of your problem so that we may be of greater assistance to you.



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▶ *AIR CLEANER* — Booklet B-1425 describes "Precipitron" electronic air cleaner for commercial, industrial applications. Includes photographs, drawings, specifications. Details installation, operation, maintenance. *Westinghouse Electric Corp., Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

▶ *AIR CONDITIONERS* — New 8 page booklet covers company's line of unit air conditioners in 3, 5, 7½ hp sizes and tells "what they will do for you." Includes photographs showing typical installations. *Frick Co., Dept. HPAC, Waynesboro, Pa.*

▶ *AIR CONDITIONING* — Bulletin DD-2 describes, illustrates dual duct system of air conditioning designed for multistory, multiroom structures. Includes listing of major features, actual installations. *Buensod-Stacey, Inc., Dept. HPAC, 60 E. 42nd St., New York 17.*

▶ *AIR CONDITIONING* — Case histories of architectural solutions to problems of efficient, economical air conditioning in old and new buildings included in reference file folder A-932. *E. I. du Pont de Nemours & Co., Dept. HPAC, Wilmington, Del.*

▶ *AIR CONDITIONING COILS* — Submittal data sheet on line of air conditioning coils for steam stresses construction features. Dimensional drawings, data charts included. *Dravo-Hanson, Inc., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

THE TRUTH ABOUT GUESSWORK ON AN AIR CONDITIONING JOB

By Bernard T. Saplin

"The day of sticking in an air conditioner without engineering the job is just about done," says Mr. Saplin, Service Manager, Kalteux Brothers, Inc., air conditioning, refrigeration and heating contractors of Schenectady, N.Y. "We handle all the air conditioning for General Electric's main plant here, and we can't guess about facts and figures when we're dealing with technical men.

"We've completely eliminated guesswork about refrigerants by specifying 'Freon'* every time," continues Mr. Saplin. "'Freon' lasts as long as the unit—pure, acid-free and dry. We've tried others, but find we change dryers *less often* and have *less trouble* with 'Freon' refrigerants."

You can eliminate guesswork about refrigerants if you ask your wholesaler for Du Pont "Freon" whenever you have an air conditioning or refrigeration job to do. Reciprocating, rotary or centrifugal compressors; household, commercial or industrial applications—there's a "Freon" refrigerant ideally suited to your installation. "Freon" is your *best* refrigerant buy, because it's pure, dry and safe—just as it has been ever since Du Pont started making it 25 years ago. Be sure to ask your wholesaler for dependable Du Pont "Freon" refrigerants.

Want more information or technical data on uses of "Freon"? Write to E. I. du Pont de Nemours & Co. (Inc.), "Kinetic" Chemicals Div. 76, Wilmington 98, Delaware.

Always ask for "Freon"

1931 KINETIC 1956

25 years of

FREON

SAFE REFRIGERANTS

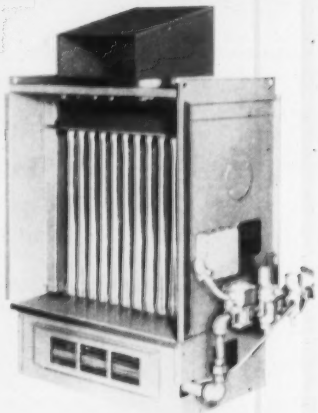
*"Freon" is Du Pont's registered trademark for its fluorinated hydrocarbon refrigerants.

DU PONT

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Here's the ideal furnace for use with packaged air conditioners

It's *Modine* STAINLESS STEEL Gas-Fired Duct Furnace



RUST and corrosion-resistant stainless steel burners and heat exchangers make the Modine Gas-fired Duct Furnace especially suitable for use with cooling coils or packaged air conditioning units. Equally adaptable to straight space heating and drying applications. Lightweight units are easier, less expensive to ship and install.

Only Modine offers all these advantages

Fast, uniform heat is assured by seam-welded, gas-tight tubes, direct-fired . . . large, self-cleaning ports.

Convenient controls are mounted on side of unit for easy access, regardless of furnace location.

Removable burner unit for easy inspection, service.

Five sizes — from 88,000 - 213,000 Btu/hr input . . . all AGA approved.

Wide application—gas-fired duct furnaces are ideal for residential, commercial, institutional buildings . . . industrial and agricultural drying, processing and ventilating.

For complete information, see the Modine representative listed in your classified phone book, or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis., for Bulletin 855.

Modine GAS-FIRED STAINLESS STEEL DUCT FURNACES

D-1311

RECENT TRADE LITERATURE

Continued

▶ *AIR DIFFUSERS* — "Architects Group" series of square and slotted ceiling diffusers covered in 12 page bulletin K-27. Selection charts, dimensions and performance data included. *Connor Engineering Corp., Dept. HPAC, Danbury, Conn.*

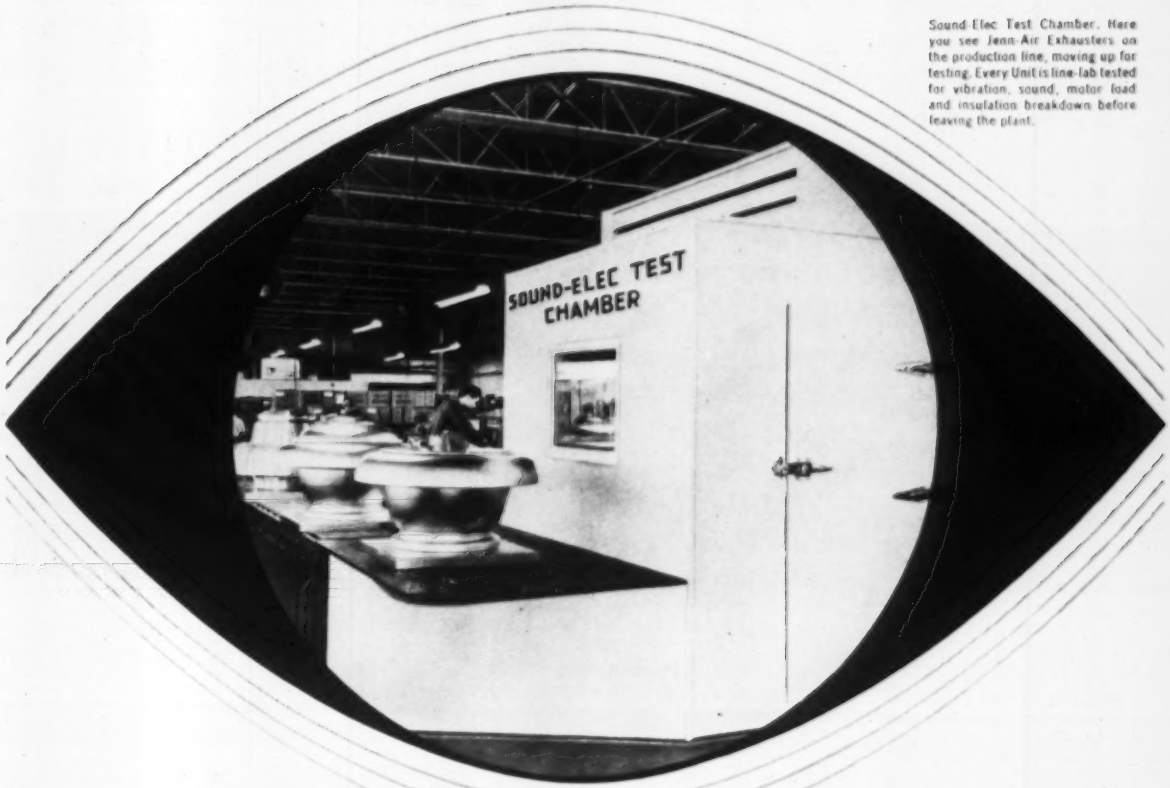
▶ *AIR FILTER* — Bulletin No. 234-C describes "Auto-Airmat" automatic dry-type air filter. Explains application, operation, construction, performance characteristics. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

▶ *ALUMINUM MILL PRODUCTS* — New 24 page booklet contains information on company's aluminum mill products, services. Brochure offers data on aluminum alloys, forms, mechanical and physical properties, applications, fabricating and finishing techniques, availability. *Kaiser Aluminum & Chemical Corp., Dept. HPAC, 1924 Broadway, Oakland 12.*

▶ *AXIAL FANS* — New 36 page catalog B-1013 describes "Series 203" axial fans for ventilation, process air supply, process air recirculation applications. Describes, illustrates tubeaxial, vaneaxial flow principles. Explains various fan arrangements possible. *American Blower Corp., Dept. HPAC, Detroit 32.*

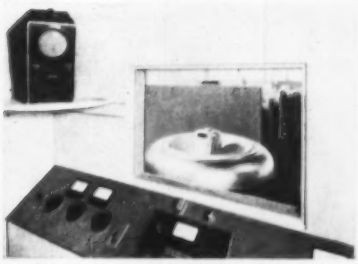
▶ *BASEBOARD HEATING* — Photographs, drawings, technical data on company's baseboard contained in 16 page booklet No. 1231. Roughing-in data, design details of typical installations, capacities, selection procedures given. *C. A. Dunham Co., Dept. HPAC, 400 W. Madison St., Chicago 6.*

▶ *BLOWERS* — Bulletin 102 details unplasticized rigid polyvinyl chloride blowers designed for expelling corrosive air, fumes, gases. Includes specification tables, chemical resistance data. *Industrial Plastic Fabricators, Inc., Dept. HPAC, Norwood, Mass.*



Sound-Elec Test Chamber. Here you see Jenn-Air Exhausters on the production line, moving up for testing. Every Unit is line-lab tested for vibration, sound, motor load and insulation breakdown before leaving the plant.

THE EYE THAT SEES SOUND



This is an interior view of the Vibronic Eye Test Chamber. Through the window is shown a Quiet-tested Exhauster which has just moved into place for testing.

LOW-CONTOUR JENN-AIR QUIET-TESTED ROOF EXHAUSTER WITH U-SPRING CUSHION SUSPENSION MOUNTING

EXCLUSIVE JENN-AIR VIBRONIC EYE TAKES THE GUESSWORK OUT OF NOISE ELIMINATION

Simulated field conditions! Yes, that is what we do here in the Vibronic Test Chamber. An acceptable noise level is established for every Jenn-Air Fan by pre-testing. Each production unit is then required to meet these rigid standards. By finding the one noisy fan in a hundred, before it goes out, service calls and complaints from the job are held to a new low in the fan industry. Further tests are made for motor load and insulation breakdown. Jenn-Air Exhausters are designed on a new principle—U-springs suspend the power unit so vibration is absorbed. Motor and blade are balanced integrally as a further protection against vibration. *RESULT—The lowest noise level ever achieved in the roof exhauster industry.*

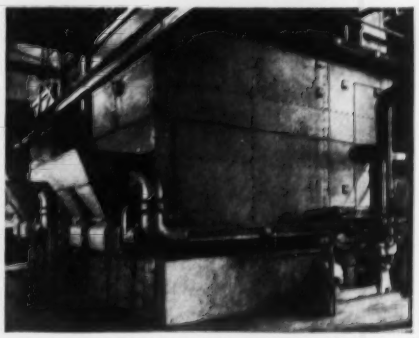
Jenn-Air Exhausters are rated in accordance with the Standard Test Code by the Texas Engineering Experiment Station.

JENN-AIR PRODUCTS COMPANY, INC.

1102 Stadium Drive Indianapolis 7, Indiana

At the Heart of most U.S.
HIGH TEMPERATURE WATER Systems
International-LaMont
FORCED RECIRCULATION GENERATORS

Here is PROVEN SUPERIORITY based on Operating Performance & Exclusive Features



Two of seven International-LaMont HTW Generators at Lockbourne Air Force Base . capacity 218,000,000 Btu/hr.

- THERMAL SHOCK ELIMINATED by exclusive BUILT IN ECONOMIZER. System return water is circulated through economizer section and brought close to saturated temperature by flue gases BEFORE reaching radiant furnace zone.
- BUILT-IN ECONOMIZER permits safe use of maximum available temperature differential between boiler outlet and system return water. Temperature differentials from 175°F to 200°F are possible and recommended. Result: lower original equipment and operating costs.
- LOW HEADROOM BOILER. Minimum height reduces cost of boiler house construction . . . permits installation in many existing structures.
- MAXIMUM HEAT ABSORPTION with minimum stack losses due to highly efficient MULTI-PASS design.
- LOWER INSTALLATION & MAINTENANCE COSTS. Exclusive unit construction reduces erection costs over 50%. Complete tubular boiler sections fabricated, tested and inspected before shipment.
- OPERATING INSTALLATIONS SINCE 1952 . . . Pressurized furnace or induced draft operation . . . Individual boiler circulating pumps or combined pump system if preferred.
- COMPLETE RANGE OF SIZES. From 6 to 200 million Btu per hour or larger . . . design pressures to 500 psi with corresponding temperatures . . . for firing with any type of fuel.

Get All the Facts

International-LaMont Forced Recirculation Generators are doing an outstanding job in providing economical high temperature water for large area heating, power and process requirements.

Bulletin 700 details the facts. Write for your copy today.

IBW **1886-1956**

THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

810 Spruce St. East Stroudsburg, Pa.

RECENT TRADE LITERATURE
Continued

▸ *BLOWERS* — Company's "Series 55" backward curved blowers covered in new catalog. Literature details performance, dimensions, other pertinent data. *Master Fan Corp., Dept. HPAC, 1323 Channing St., Los Angeles 21.*

▸ *BOILER FEEDWATER CONTROLLER* — Form 5623 is 4 page folder that suggests a solution to high initial, operating and maintenance costs of boiler water level control. Applicable to new boiler plant construction or where replacement of existing steam generating equipment is of immediate concern, says company. *C. E. Squires Co., Dept. HPAC, 18502 Syracuse Ave., Cleveland 10.*

▸ *BOILERS* — Catalog AP-237-F describes, illustrates line of steel boilers for heating commercial and industrial buildings, homes. Literature presents ratings, capacities, dimensions, engineering data for complete line. *Pacific Steel Boiler Div., National-U. S. Radiator Corp., Dept. HPAC, Johnstown, Pa.*

▸ *BRASS FITTINGS* — Catalog 156 describes company's line of brass fittings for service in air conditioning, refrigeration, oil, gas, other fields. *Span Brass Mfg. Co., Dept. HPAC, Otsego, Mich.*

▸ *CANNED MOTOR PUMPS* — New 4 page bulletin 1040 describes, illustrates construction, operation of high temperature "Series T" canned motor pumps. Details on performance, materials of construction, dimensions, power requirements, other specifications given. *Chempump Corp., Dept. HPAC, 1300 E. Mermaid La., Philadelphia 18.*

▸ *COOLING COILS* — Catalog DE-200 describes company's new line of direct expansion cooling coils, using its "Turbo-Flo" finned surface, designed for high heat transfer. Covers

PLUS values in power

the SMOOTH STREAMLINED CONTOURS

of HOWELL series one hundred motors . . .

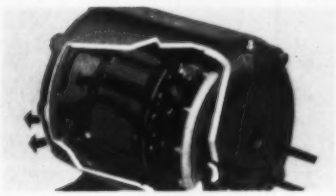
LOOK BETTER ON YOUR MACHINES,

HAVE NO DUST CATCHING FINS OR OFFSETS

Designed for the Age of Automation, these sleek, new Howell Series 100 Motors add a plus value in modern good looks to your machines and equipment. Their streamlined contours are functional, too — no fins, ribs or unnecessary offsets on frames or end plates to collect dust deposits. Results: a motor that never loses its cool-running efficiency, good appearance that's easy to maintain, and a minimum of fire hazard from dust accumulations.

When you are selecting power units for your machines, why not consider superior good looks — they cost no more! Specify Howell Series 100 to get this and all the other plus values of today's most modern industrial motors.

GET THE PLUS values THAT COUNT.. specify HOWELL series 100 motors



heat-source ventilation licks tough applications

Wide stator slots provide 50% more contact between fan-driven air and stator laminations, main source of motor heat. To get an extra cool running motor, specify Series 100!

bearing protection doubled for longer motor life

Double shielded bearings are sealed in by end-plates and inner bearing caps—doubled protection; doubled dependability. And Howellube greasing is *another* plus value!

steel frames and feet— greater strength, less weight

Unlike cast iron, Howell's steel frames and feet won't crack under the stress of accidental mishandling or the excessive tightening of mounting bolts. Another plus value that counts.

For more details on Series 100 motors, write for Bulletin N-100-R

HOWELL Red Band MOTORS

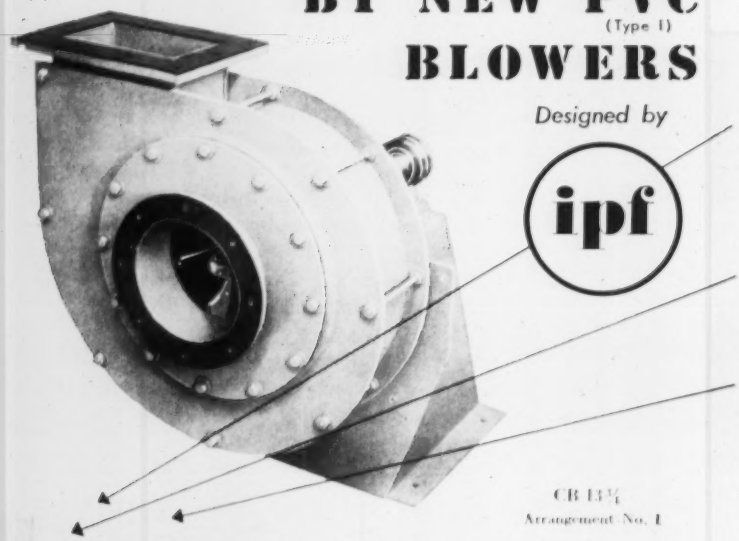
HOWELL MOTORS

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

OUTMODED BY NEW PVC (Type I) BLOWERS

Designed by **ipf**



CB 13¾
Arrangement No. 1

If your problem is expelling corrosive fumes and gases, you need IPF Blowers. Ordinary blowers are susceptible to attack by these fumes and gases. Coating the blower is costly and not foolproof. Maintenance and replacement costs are high . . . and valuable time is lost. Result—an expelling operation that eats into profits.

For trouble-free, long-life blowers, specify **IPF** blowers made of Unplasticized, Rigid Polyvinyl Chloride (UPPVC). UPPVC—the new construction material—exhibits inherent anti-corrosive qualities that allows **IPF** Blowers to withstand most chemical fumes and gases from 40°F to 140°F. Actual installations of **IPF** Blowers have lasted three times the normal life of ordinary blowers . . . and continue to function efficiently.

UPPVC is a lightweight . . . smooth surfaced . . . nonporous material of construction. Lightweight construction means greater capacity per B.H.P. . . . easier installation . . . reduced handling problems. Smooth, nonporous finish never require painting or maintenance expense. **IPF** Blowers are not subject to unbalance from chipping of a protective coating . . . because there is no coating. It's solid UPPVC.

IPF Blowers made of UPPVC are available in standard sizes that provide displacements from 143 C.F.M. to 7722 C.F.M. Standard wheel sizes of 9½, 13¾, 19, and 27 inches. Other sizes and capacities can be custom designed to fit special requirements. Full details on the new **IPF** Blowers available upon request.

Full details on the new IPF Blowers available on request.

MANUFACTURED BY
industrial plastic fabricators, inc.
NORWOOD, MASS. NOrwood 7-3411

RECENT TRADE LITERATURE

Continued

construction of coils, including tubing, casings, headers, refrigerant distribution, return bends, valves. *Halstead & Mitchell, Dept. HPAC, Bessemer Bldg., Pittsburgh 22.*

▶ *COMBUSTION METERS* — New 4 page catalog 56-553-1 contains photographs of different types of chemically operated CO_2 analyzers, recorders. Descriptions of operation, sampling system accompanied by drawings. *Hays Corp., Dept. HPAC, Michigan City, Ind.*

▶ *CONTROLLED VOLUME PUMPING* — Text, illustrations of recent talk given before ISA on factors governing accuracy in controlled volume pumping presented in technical paper No. 65. *Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Ln., Philadelphia 18.*

▶ *CONTROLS* — Catalog D-31 covers products, services offered by company for field of automation. Some products covered are differential transducer control and automation systems, line of time control equipment including electronic, equipment operator mechanisms, valves, counters, electronic contactors. *Automatic Temperature Control Co., Inc., Dept. HPAC, 5200 Pulaski Ave., Philadelphia 44.*

▶ *CONTROL VALVES* — New 8 page catalog contains capacity data, selection information for solenoid valves, back pressure regulators, evaporator controls, condensing water regulators for medium and large air conditioning, industrial refrigeration applications. *Refrigerating Specialties Co., Dept. HPAC, 3004 W. Lexington St., Chicago 12.*

▶ *COUPLINGS* — Catalog contains specifications, illustrations of company's line of "quick-connective" couplings for services such as pressure and vacuum fluid line, pneumatic, hydraulic, oxygen, acetylene,

B.F.Goodrich

How Cell-Tite® solves 2 miles of condensation problems

Supplied in 50 foot rolls, tubing can be custom cut for the job, eliminating waste and reducing costs.

Flexible Cell-Tite tubing is ideal for short, sharp curves of copper tubing. Except for modernizing existing installations, piecing or gluing is unnecessary.

AFTER a recent air conditioning installation that required over 11,000 feet of Spongex Cell-Tite tubing, Mr. Charles Ross, President, Economy Plumbing & Heating Co., Chicago, said:

"Spongex Molded Cell-Tite is in a class by itself as an insulation material on flexible copper tubing. It certainly has solved a long-standing problem. We'd tried everything in the past; some were too slow and sloppy, others too bulky and rigid, and still others were supplied only in 3-foot lengths.

"With Cell-Tite, cutting the tubing to length is no problem at all. We simply use ordinary scissors. We don't have any messy gluing problem. Actually, the most inexperienced workmen can slip this material around a coupling, and achieve a tight fit."

Spongex Cell-Tite is durable rubber with millions of non-interconnecting cells, each acting as a separate insulator. This means Cell-Tite tubing not only protects against moisture condensation in the summer, but also withstands the high temperatures of winter heating.

As tubing, Spongex Cell-Tite is made with standard outside diameters of ⅜", 1", 1¼", 1½", and can be made 1⅜", 1¾" and 2". Almost any inside diameter is available up to ¼" of the outside diameter in lengths up to fifty feet.

For more technical information write B. F. Goodrich Sponge Products Division, 281 Derby Place, Shelton, Conn.

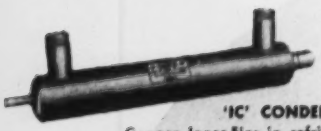
B.F.Goodrich

SPONGE PRODUCTS DIVISION

281 DERBY PLACE, SHELTON, CONNECTICUT

heat-x HEAVY DUTY UNITS

...Equipment you can Rely on



'IC' CONDENSERS
Copper Inner-Fins in refrigerant passages. All water passages of non-ferrous construction. 5 to 150 Tons.

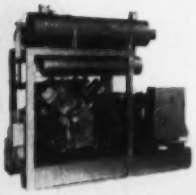
'CH' WATER CHILLERS
Copper Inner-Fins in refrigerant passages. Water passages of non-ferrous construction. Single pass. 2 to 90 Tons.

'RX' HEAT INTERCHANGERS
Inner-Fin construction. No oil trapping problem. Low Freon charge required. 7½ to 100 Tons.

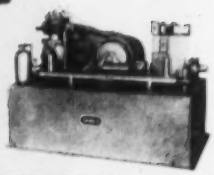
Advanced engineering design, copper construction of all water passages, quality materials and careful workmanship throughout assure the solid reliability of all these heavy duty Heat-X products. Write for descriptive catalogs on these or other Heat-X units.

'HX-ETI' LIQUID COOLERS
Combinations of cast aluminum coolers simply constructed with separate liquid and refrigerant coils cast in aluminum blocks.

'PCL' CHILLER ASSEMBLIES
For those who prefer to tie in their own condensing unit and water pump. Construction the same as 'PC' line. 10 to 90 Tons.



'PC' WATER CHILLERS
Inner-Fin construction of refrigerant passages means greater cooling capacity, far less bulk. Completely "packaged" units: wired, ready to install. 2 H.P. through 100 H.P. Capacity control, available on 2 H.P. through 15 H.P. models for use with hermetic and semi-hermetic units, eliminates short-cycling during light load conditions and maintains constant suction pressure.



'CCP' PACKAGE CHILLERS
Combinations of cast aluminum coolers. Complete, ready to install. No danger of freeze-up damage. Hermetic or open compressors available. ½ H.P. through 10 H.P.

HEAT-X, Inc.
BREWSTER • NEW YORK

RECENT TRADE LITERATURE

Continued

steam, various gases and liquids. *Hansen Mfg. Co., Dept. HPAC, 4031 W. 150th St., Cleveland 11.*

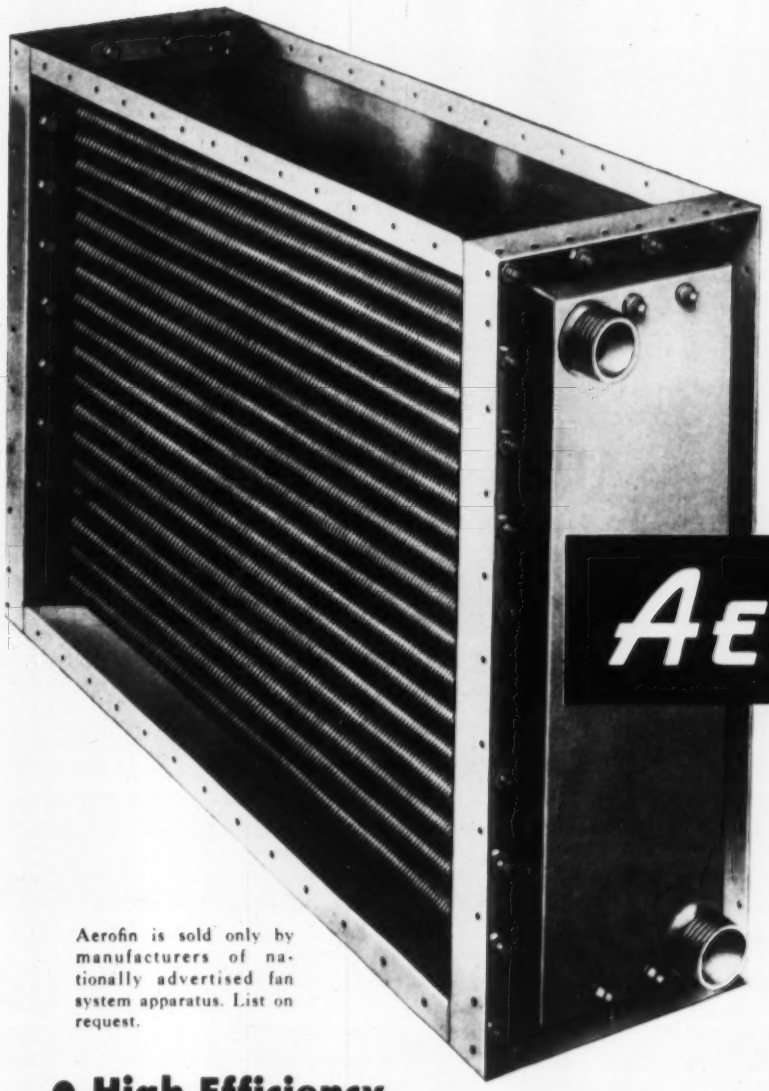
▶ *D-C AMPLIFIERS* — New d-c amplifying instrument described in 4 page data folder. Literature contains details, schematic drawings of four typical applications of instrument, as well as general technical information concerning voltage, current amplification. *Fielden Instrument Div., Robertshaw-Fulton Controls Co., Dept. HPAC, 2920 N. Fourth St., Philadelphia 33.*

▶ *DETERMINING CARBON DIOXIDE IN WATER* — Technical paper No. 133, *Determination of Carbon Dioxide in Water by Conductivity Measurements*, describes new method designed to analyze waterside deposits, treatment chemicals, organic carbon in water. *W. H. & L. D. Betz, Dept. HPAC, Gillingham and Worth Sts., Philadelphia 24.*

▶ *DIFFUSERS* — New 16 page catalog shows typical installations, lists suggested applications for "Stripline Distinctive" diffusers. Selection procedure, performance charts and tables included. *Air Devices, Inc., Dept. HPAC, 185 Madison Ave., New York 16.*

▶ *DUST COLLECTORS* — Complete line of cabinet cloth filter and cyclone separator type dust collectors pictured, described in 16 page catalog. Included is list of operating, construction features, details of each model, accessories, optional, equipment, selection information, specifications. *Torit Mfg. Co., Dept. HPAC, 287 Walnut St., St. Paul 2.*

▶ *DRAFT INDUCERS* — Bulletin I-56 details line of draft inducers for heating boilers, boiler plants. New features listed. Selection table included. *L. J. Wing Mfg. Co., Dept. HPAC, 140 Vreeland Mills Rd., Linden, N.J.*



AEROFIN

Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

● High Efficiency

● Long Service Life

● Low Maintenance Costs

You are assured of high efficiency in heating or cooling — long service life — low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively* — offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research — and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

AEROFIN CORPORATION
101 Greenway Ave.
SYRACUSE 3, N. Y.

Now—a Complete Line of R-P&C Solder End Valves

BRONZE GATES, GLOBES, CHECKS

• Now you can get R-P&C solder end valves similar to the **Fig. 90 gate valve** above in globe valve and check valve styles. They have been especially developed for use with K, L or M copper tubing on hot and cold water, or low pressure steam lines in plumbing, heating and air conditioning systems.

All are rated for 125 lbs. in steam service, or 200 lbs. with oil, water or gas. Gates are provided in sizes from ⅜" to 3", globes from ¼" to 2", checks from ⅜" to 2".

FREE SLIDE RULE

Valve selector slide rule gives all dimensions for iron body and steel valves in pressure classes from 150 to 1500 lbs. Write for yours.

These new valves reflect the quality construction features, typical of the complete R-P&C line, which result in longer life, lower maintenance and easier installation. They are presented in a wide range of styles—for example, the gate valves are supplied with either rising or stationary stem, and solid or split wedge. Each valve is hydrostatically tested at a pressure of 350 pounds before leaving the factory.

Your R-P&C distributor has these valves in stock now—or he can get them for you. Write Reading office for complete catalog.

ACCO

TRADE MARK

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

RECENT TRADE LITERATURE

Continued

▸ *ELEVATING TRUCK* — Brochure describes new one-man truck designed to deliver, install air conditioners from truck to ground, upstairs or down, into customer's window. *Fairbanks Co., Dept., HPAC, 393 Lafayette St., New York 3.*

▸ *FAN* — Controllable pitch heat exchanger fan described in Bulletin A-113. Unit designed to hold fluid temperature to ± 1½ F deg, save up to 50 percent on power consumption. *Hartzell Propeller Fan Co., Dept. HPAC, Piqua, Ohio.*

▸ *FAN CLUTCHES* — Technical report is analysis of engineering features of "custom-engineered" fan clutches. Operation, methods of control described. Varying types of mountings listed. *Warner Electric Brake & Clutch Co., Dept. HPAC, Beloit, Wis.*

▸ *FANS* — Class III fans designed for high velocity air conditioning covered in bulletin DS-348-C. Details about fan bases, drives, motors, etc. included. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▸ *FASTENING TOOL* — Two new booklets show different ways fastening tool can be used. One shows how unit can be used for plant maintenance such as fastening fan and blower mounts, sprinkler pipes. Other tells how can be used for lead lining tanks *Ramset Fastening System, Olin Mathieson Chemical Corp., Dept. HPAC, 12117 Berea Rd., Cleveland 11.*

▸ *FILTERS* — Data on construction, installation, testing and performance of "Ultra-Aire" space filter with new filter media contained in 4 page bulletin No. 1505-3. Illustrations show form, dimensions of four standard units with capacities ranging 35 to 1000 cfm. *Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8.*

Manufacturers' Agents...

Are you interested in securing additional lines?

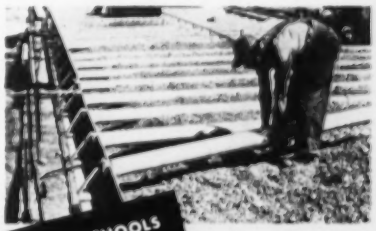
We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

HEATING, PIPING & AIR CONDITIONING
6 North Michigan Avenue, Chicago 2, Illinois

For in-slab warm air systems...

Transite* Warm Air Duct is specified for trouble-free service



Transite Warm Air Duct is easily installed. Its joints are assembled quickly, simply. It never needs anchoring. It easily withstands rough handling and impact of poured concrete. Transite Warm Air Duct resists corrosion. Made of asbestos-cement, Transite's corrosion resistance and long trouble-free life are a matter of record. And, it is priced for competitive bidding. Write today for further information: Address Johns-Manville, Box 60, New York 16, New York. (In Canada, Port Credit, Ontario.)

*Transite is a Johns-Manville registered trademark

Johns-Manville TRANSITE WARM AIR DUCT
an asbestos-cement product

Flexon® Expansion Compensators Proved for Heating Systems in Rugged Railway Service

IMPORTANT DATA ON EXPANSION CONTROL

Heating System Expansion Control Guide

Flexon Expansion Joint Design Guide

For further information, write for these descriptive bulletins

The Flexon Expansion Compensators installed in the floor heating system piping of American Car and Foundry Division's new lightweight train of the future, the TALGO, are called upon for double duty. In addition to their normal function of expansion control, they contribute to ACF's design objectives of isolation of objectionable noise and motion when the TALGO is on the move.

Their exceptional performance under such operating conditions is a plus recommendation of their suitability for all types of buildings. Especially designed and engineered to replace outmoded, troublesome methods of pipeline expansion control, these units eliminate the noise of pipe creeping and assure long leakproof service. Easily installed, they are space savers that require no access panels because they require no maintenance—for the life of the piping system.

Flexonics Corporation manufactures a low pressure compensator for horizontal runs in baseboard heating lines . . . a high pressure unit for steam and hot water risers and horizontal runs.

Remember . . . you can install with confidence when it bears the name "FLEXON."

FLEXON® QUALITY
proved in service and backed by over 54 years manufacturing experience

Flexonics *Corporation*
EXPANSION JOINT DIVISION
1391 S. THIRD AVENUE, MAYWOOD, ILLINOIS
FORMERLY CHICAGO METAL HOSE CORPORATION
Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components.
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

EC 20

RECENT TRADE LITERATURE

Continued

▸ *FILTRATION* — "Ultra-Filtration," designed to provide "super" clean air at low cost, covered in 4 page bulletin No. 557-D. Dimensional drawings, size and specification tables included. *Wheelabrator Corp., Dept. HPAC, 344 S. Byrkit St., Mishawaka, Ind.*

▸ *FITTINGS, FLANGES* — Wrought iron welding fittings, flanges described in new folder. Dimensional data on products in sizes ½ to 12 in. given. Physical properties discussed. Typical applications illustrated. *Tube Turns, Dept. HPAC, 224 E. Broadway, Louisville* 1.

▸ *FOLDERS, BRAKES* — Bulletin 71 presents air actuated and hand operated folders and brakes. Details, specifications given for each model. *Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo* 11.

▸ *FRACTIONAL HP MOTORS, BLOWERS, FAN BLADES* — New catalog lists uses, performances of company's line of fractional horsepower electric "MicroMotors," blowers, fan blades, replacement kits, accessories. *Redmond Distributors, Inc., Dept. HPAC, 201 Monroe St., Owosso, Mich.*

▸ *GATE VALVE* — Renewable seat ring gate valve, designed so that it never has to be removed from line to replace seat rings, detailed in brochure. Series of photographs shows how seat rings are replaced. *Fairbanks Co., Dept. HPAC, 393 Lafayette St., New York* 3.

▸ *GRILLES, REGISTERS* — New 18 page catalog covers company's line of standard and custom made registers, grilles for industrial, institutional, domestic uses. Contains illustrations, technical information, dimensions, schematic drawings, list prices. *Louvra Mfg. and Sales Co., Dept. HPAC, Union, N.J.*

RECENT TRADE LITERATURE

Continued

▶ *HAND TACHOMETERS* — Hand tachometers illustrated, described in bulletin AT 135. Contains information on how to use, list of applications. *Clarence J. Marx Co., Dept. HPAC, P.O. Box 1033, Cleveland 23.*

▶ *HEAT LOSS DATA* — Graph gives surface temperatures, heat losses for mineral wool block-and-cement combination insulation. Thicknesses of block to 4 in., hot surface temperatures to 220 F—covered. *Baldwin-Hill Co., Dept. HPAC, 500 Breunig Ave., Trenton.*

▶ *HEATERS, HEATING DEVICES* — Bulletin GEC-1005G contains application index, calculating data, specifications, operating information for company's electric heaters, heating devices. Process and application index shows methods of heating, type of heater recommended for various processes. *General Electric Co., Dept. HPAC, Schenectady 5, N.Y.*

▶ *HEATING, VENTILATING, COOLING SYSTEM* — File No. 2180A contains roughing-in data for company's "Vari-Air" system for heating, ventilating, cooling schools. Capacity table, charts included. *C. A. Dunham Co., Dept. HPAC, 400 W. Madison St., Chicago 6.*

▶ *HUMIDITY SENSING ELEMENT* — Bulletin No. 1 details operation, lists features for humidity sensing element designed for accurate measurement over wide temperature range. *El-Tronics, Inc., Dept. HPAC, 1420 Walnut St., Philadelphia 2.*

▶ *INDUSTRIAL SPRAY NOZZLES* — New 20 page catalog I covers manufacturer's line of industrial spray nozzles and accessories. Includes illustrations, dimensional drawings, capacity tables. *Monarch Mfg. Works, Inc., Dept. HPAC, 2501 E. Ontario St., Philadelphia 34.*

▶ *INSULATING PLASTIC* — Four page booklet covers insulating plas-

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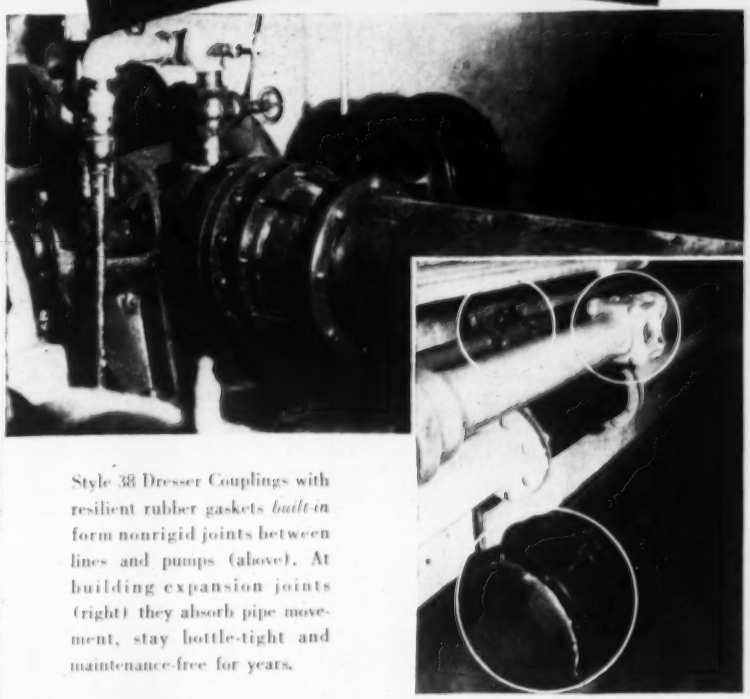

Style 38 Dresser Couplings with resilient rubber gaskets *built-in* form nonrigid joints between lines and pumps (above). At building expansion joints (right) they absorb pipe movement, stay bottle-tight and maintenance-free for years.

Whatever, wherever your pipe-joining jobs, Dresser Couplings mean time and money saved!

No troublesome aligning and joining problems, no complicated or costly operations. All you have to do is bring plain pipe ends together, Dresser-couple them, tighten the bolts with a wrench . . . and the job is finished. Dresser Couplings' resistance to impact, vibration and corrosion means highest dependability. Well suited to plant installations, they're easy to take off and transfer.

Style 65 Fittings come in sizes from 3/8" to 2"; Style 38 Couplings are available to 12" OD and over.

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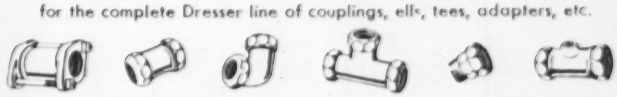
for the complete Dresser line of couplings, ells, tees, adapters, etc.



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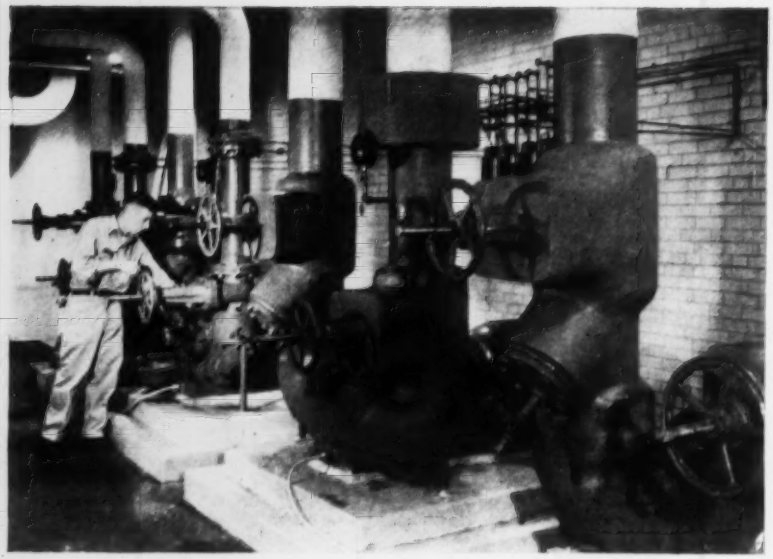
Dresser Manufacturing Division, 79 Fisher Ave., Bradford, Pa.



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"BUFFALO" — THE PUMPS OF KNOWN TOP QUALITY

It's a real satisfaction to *know* the pumps won't be a weak link in your installation. And you *can* know it, when you order "Buffalo" Pumps — their record for reliability over the past 79 years is proof. But even more important to you, they embody the best and latest practical developments in the light of all this experience.

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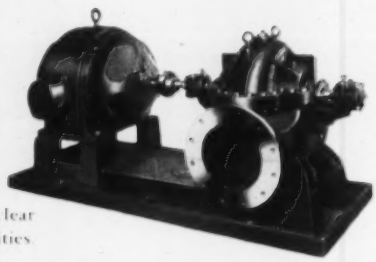
*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



"Buffalo" Double Suction Pump for clear water service. 10 to 14,000 gpm capacities.

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RECENT TRADE LITERATURE

Continued

tic designed for easy application. Uses outlined, including insulation of steam and hot water pipes, hot water tanks, flue openings, boilers, warm air ducts. *Zonolite Co., Dept. HPAC, 135 S. LaSalle St., Chicago.*

▸ *INSULATION* — New 20 page catalog on company's line of thermal insulations and refractories provides information on composition, physical and thermal properties and sizes of various products. *Johns-Manville, Dept. HPAC, 22 E. 40th St., New York 16.*

▸ *INSULATION* — Twelve page leaflet, which accompanies sample of "Foamglas" insulation, tells how to maltreat insulation to prove its qualities. *Pittsburgh Corning Corp., Dept. HPAC, 1 Gateway Center, Pittsburgh 22.*

▸ *MACHINING TUBING, PIPE* — Four page folder TDC-132 furnishes information about various machining operations on stainless pipe, tubing. Tooling, power requirements, cutting oils, finishing, drilling, threading, reaming, milling, sawing discussed briefly. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *MEASURING INSTRUMENTS* — Catalog GEC-1016 contains product information including applications, sources of additional information, pictures of 30 different devices for laboratory and production testing. *General Electric Co., Dept. HPAC, Schenectady 5, N.Y.*

▸ *MOUNTINGS, BASES* — Line of "Floating Rail" vibration mountings and fan and motor bases described in catalog FR-55. Detailed descriptions of design features, illustrations of typical installations and schematic drawings given. *T. R. Finn & Co., Inc., Industrial Div., Dept. HPAC, 200 Central Ave., Hawthorne, N.J.*

RECENT TRADE LITERATURE

Continued

▶ *O-RINGS, CUSTOM MOLDED RUBBER PRODUCTS* — Engineering handbook No. 525 contains charts, illustrations, graphs, engineering data in development of O-ring seal design information on internal and external grooves, gland finishes, chamfers, selection of gland, piston rod, cylinder materials, lubrication. *Plastic and Rubber Products Co., Dept. HPAC, 2100 Hyde Park Blvd., Los Angeles 47.*

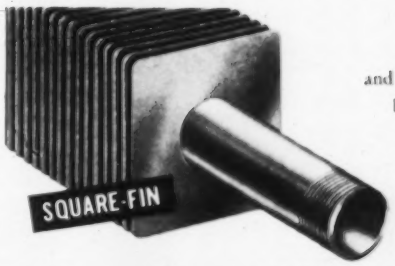
▶ *PACKAGED CHILLERS* — Form ACC-179 describes, contains capacity data on more than 30 different models of packaged liquid chillers in company's line. *Airtemp Div., Chrysler Corp., Dept. HPAC, Dayton.*

▶ *PACKAGED CHILLERS* — Bulletins C-K.622A and C-K.622W cover air cooled and water cooled models, respectively, of company's packaged water chillers in 2, 3 ton sizes. *Drayer-Hanson, Inc., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

▶ *PACKINGS* — "Teflon" packings, gaskets illustrated, described in new 8 page bulletin. Service recommendations for each type packing included, as well as sizes in which they are available. *Raybestos-Manhattan, Inc., Packing Div., Dept. HPAC, Manheim, Pa.*

▶ *POTENTIOMETER* — New 64 page bulletin PI245A covers "Dynamaster" electronic potentiometer and bridge instruments for recording, controlling. *Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

▶ *PROTECTIVE RELAY MAINTENANCE* — Data sheet 156UB is general discussion of protective relay maintenance and testing with particular attention to equipment and records necessary for assuring safely operative relays, breakers. *Multi-Amp Corp., Dept. HPAC, 10 Third St., Newark.*



All *Slant-Fin* products — heating elements and enclosures — are advance-engineered and built to exacting specifications. Regardless of the application, *Slant-Fin* can meet your requirements either with a standard item from an extensive line or fabricate an assembly for your special needs.

WHEN YOU NEED FINNED-TUBE FOR HEATING...REMEMBER THESE

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WHY YOU SHOULD ALWAYS SPECIFY

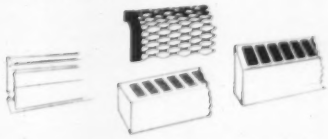
SLANT-FIN

1. Highest heat output

You have a choice of heating elements — the traditional Square-Fin Series or the distinctive Slant-Fin Series with many exclusive advantages. With greater surface per fin and interlocking fin-and-flange construction, these elements supply a high heat output per linear foot. A variety of fin spacings and tube sizes from ¾" to 2" provide a complete range of approved ratings.

2. The most complete line for commercial heating

For office buildings, factories, churches, schools, hospitals and other large area heating installations, *Slant-Fin* radiators and enclosures are unsurpassed. Heating elements in 1¼" and 2" all-steel, all-copper or copper-aluminum provide maximum heating efficiency with economical material and labor costs. A wide range of enclosures from the practical expanded metal to the ultra-modern "low line" permits complete flexibility for individual requirements.



3. Residential baseboard, too

For private offices, hotel rooms, motels, or any small space where both heating efficiency and appearance are desired, *Slant-Fin's* complete line of residential baseboard is ideal. Again, you have a wide choice. Four different heating elements of ¾", 1" and 1¼" are available in all-steel or copper-aluminum. Three different enclosure styles, too.

4. Labor and material savings

Slant-Fin products are made to be installed in the shortest possible time. For example, snap-on enclosures eliminate the need for screws, tools or special mountings. And both heating elements and enclosures are supplied in pre-cut lengths, tailored to your job.

5. Special applications

For special industrial and commercial process applications, either heating or cooling, *Slant-Fin* has the engineering experience and exclusive production techniques to fabricate finned-tube to the user's particular needs. Whether made of stainless or galvanized steel, wrought iron or aluminum, the finished assemblies will meet the most rigid tests for quality construction and efficiency.

You owe it to your reputation to include Slant-Fin in your plans. Catalog 1000 describes Slant-Fin's commercial and residential line. Write today for your copy.

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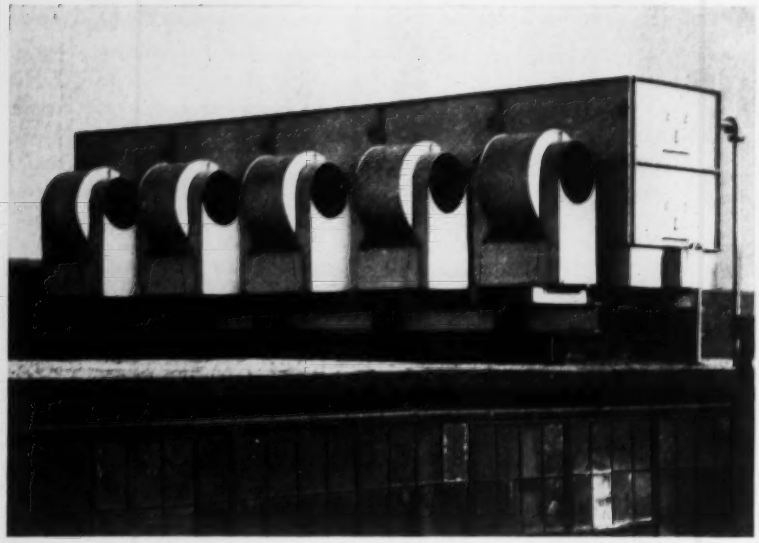

Victor Mfg. & Gasket Company says:

"Binks Cooling Tower keeps mill rolls within 5° F. tolerances..."

"We are extremely pleased with the high efficiency of the Binks Cooling Tower," reports Mr. Hilary Torchal, Plant Engineer, Victor Mfg. & Gasket Co., Chicago. This internationally-known manufacturer of gaskets, oil seals and packings recently installed a Binks Series 3-B Mechanical Draft Cooling Tower when its mixing and milling department was enlarged.

"Finding the right cooling equipment for the machinery in this department was very important to us. In laminating molded synthetic rubber on the rolling mills, great frictional heat is generated. And if the surface temperature of the rolls rises as little as 5° the rubber may adhere to the rolls. If this occurs, the batch is ruined.

"Since we installed the Binks Tower not a single batch of material has been spoiled because of adhesion. They are so efficient in transferring heat from the water sprayed inside these rolls that the temperature is always maintained at a safe level. And because the cooling water is re-circulated, we no longer are bothered by unexpected water pressure drops."

Binks Series 3-B towers are modern forced-draft units using a dry blower air propulsion system. The towers obtain high cooling efficiency by thorough water break-up combined with internal redwood nailless decking. Counter-current operation moves air in the opposite direction to water flow.

"Whisper-quiet" performance permits the use of this type of tower by hotels and hospitals, and by firms located in crowded residential areas.

Another important feature of the Series 3-B Tower is its low silhouette, 7'6" overall height, plus the underlying supporting foundation. In many cases, these towers can be placed to be seldom visible from the street level.

ENGINEERING HELP AVAILABLE

Binks manufactures cooling towers of all types and capacities...from small residential-types of 3 gpm to giant towers of 15,000 gpm. To help you get the right tower, a Binks engineer will study your needs and submit proposals without obligation. For complete details write to the address below:

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EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

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RECENT TRADE LITERATURE

Continued

▸ *PUMPS* — Bulletin 121-A details company's line of "nonclog" pumps for handling solids in suspension. Eight page booklet covers vertical, horizontal, close-coupled types. Proposed specifications for use by architects, engineers included. *Aurora Pump Div., New York Air Brake Co., Dept. HPAC, Aurora, Ill.*

▸ *REDUCTION GEARS* — Booklet DB 1165 describes "high speed" reduction gears for mechanical drive steam turbines. Literature covers various parts of gear assembly, lists dimensional and weight specifications. Drawings of assembly included. *Westinghouse Electric Corp., Dept. HPAC, P.O. Box 2099, Pittsburgh 30.*

▸ *"RIBBON" BURNERS* — Gas fired heating units, designed to provide narrow, uniform sheet of flame, detailed in 8 page bulletin SC-1004. Burners recommended by company for continuous heat processing applications. *Selas Corp. of America, Dept. HPAC, Dresher, Pa.*

▸ *ROTARY DISPLACEMENT PUMPS* — Engineering data covering "All-Chem" rotary displacement pump line for corrosive, hazardous fluids contained in bulletin AC 56. General description of design and applicability is followed by construction and performance data, operating specifications, dimensional data, information on component material, drives and mounts. *Eco Engineering Co., Dept. HPAC, 12 New York Ave., Newark.*

▸ *RUST, LIME SCALE REMOVAL* — Removal of rust, lime scale by soaking or circulating is subject of new folder. Booklet describes action of company's compound "No. 32," an inhibited liquid descalant, which is said to eliminate mechanical scraping or rodding out. *Oakite Products, Inc., Dept. HPAC, 19 Rector St., New York 6.*

RECENT TRADE LITERATURE

Continued

▸ *SCHOOL HEATING, VENTILATING* — Four page reprint, *Continuous Slot Air Delivery Under Large Windows Prevents Drafts*, describes temperature control, air distribution system in new school under construction. *Barber-Colman Co., Dept. HPAC, Rockford, Ill.*

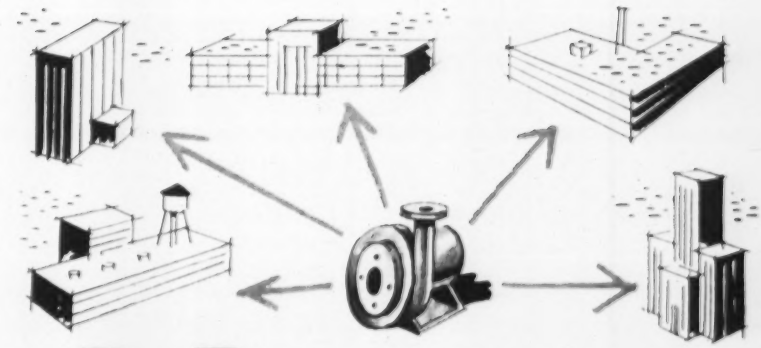
▸ *SECTIONAL CONDENSERS* — Bulletin No. 130 cites benefits of sectional design refrigeration condensers for 100 to 240 lb refrigeration capacity. Explains their functions with diagrams, installation photographs. *Niagara Blower Co., Dept. HPAC, 405 Lexington Ave., New York 17.*

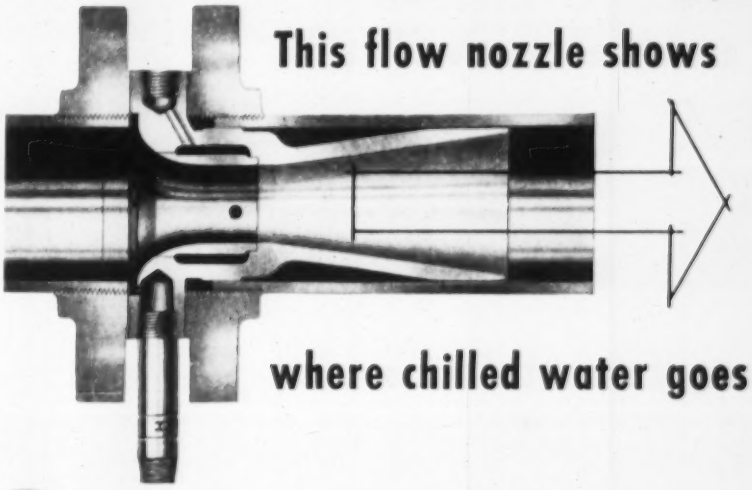
▸ *SLIDE VALVES* — Data sheet Ub describes company's line of slide valves designed for use in pipeline transporting solid materials in liquids. Details of construction covered in text and illustrated, together with operating mechanisms for manual or power operation. *Allen-Sherman-Hoff Co., Dept. HPAC, 259 E. Lancaster Ave., Wynnewood, Pa.*

▸ *SOLENOID VALVES* — Electrically operated two-way solenoid valves for air, gas, steam, liquid flow control described in catalog 200. Dimensions, specifications, pressures, applications of valves in bronze and stainless steel listed. *Atkomatic Valve Co., Inc., Dept. HPAC, 545 W. Abbott St., Indianapolis.*

▸ *STAGED CYCLE, CLOSED REVERSING CYCLE* — New 12 page booklet with flow charts covers company's "staged cycle" and "closed reversing cycle" methods designed to reduce "inefficiencies in cooling, refrigeration." *A.J. McFarlan Co., Inc., Dept. HPAC, 90 West St., New York.*

▸ *STAINLESS STEELS* — Ten page booklet, *The Chromium-Nickel-Manganese Austenitic Stainless Steels*, contains charts, graphs, information





This flow nozzle shows where chilled water goes

Builders-Providence, Inc., leading manufacturer of flow nozzles and tubes, offers the Model NZIF Insert Nozzle as a real money-maker in air conditioning systems. Commercial buildings, shopping centers, and other multiple occupant buildings find this precision nozzle the ideal metering element for accurate measurement of chilled water usage.

Here's why this flow nozzle is so widely accepted:

PRESSURE/TEMPERATURE PROOF: insert design withstands same pressures and thermal shocks as pipe itself.

ENDURING ACCURACY: precision machining throughout bronze throat liner and contoured inlet. Perpendicularly drilled and reamed piezometer taps.

LOW HEAD LOSS: efficient Venturi outlet cone assures high pressure-head recovery – permits use of smaller pumps, motors, piping.

EASY INSTALLATION: pressure taps are built-in . . . no special measurements or machining required in field.

MULTIPLE THROAT VENTS: for accurate metering even with upstream flow disturbances.

Bulletin 130-K3A gives complete dimension, capacity, and other data . . . shows how easy it is to install this efficient flow nozzle . . . gives detailed accuracy and pressure recovery information. Write for your copy to BUILDERS-PROVIDENCE, INC., 381 Harris Ave., Providence 1, Rhode Island.

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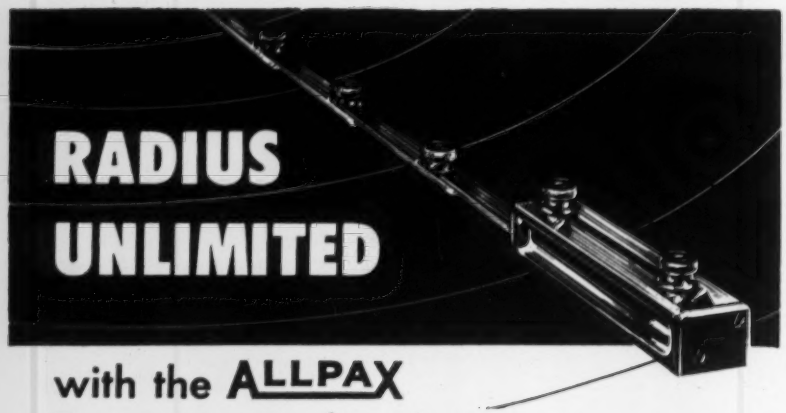

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There is no gasket too large to be cut with the Allpax Extension Gasket Cutter. With the simple addition of extra 6" extension arms, the radius can be increased as required. Without extensions this handy, versatile tool cuts diameters from ¼" to 12".

Make replacement gaskets quickly and easily with the Allpax Extension Gasket Cutter and avoid costly delays in operation.

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Sizes 3" to 36" ID Wide
Pitch type *RETRACTABLE*

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Sizes 1¼" to 36" ID
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Bulletin 241 — Accessories and Installation Data
Bulletin 242 — Technical data on products and service.
Bulletin 243 — Application data and type selector guide.
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RECENT TRADE LITERATURE

Continued

on cold rolled mechanical properties, elevated temperature properties, physical properties, corrosion resistance. *Allegheny Ludlum Steel Corp., Dept. HPAC, 2020 Oliver Bldg., Pittsburgh 22.*

▶ *STORAGE TANK HEATING COILS* — New 4 page bulletin ATH 55 describes heating coils for heating storage tank water with live or exhaust steam or with circulating boiler water. Conversion factor table, rating and dimension chart included. *Alstrom Corp., Dept. HPAC, 790 E. 176th St., New York 60.*

▶ *SUBMERSIBLE PUMP MOTORS* — Design, construction of water lubricated submersible pump motors illustrated in 12 page booklet. Cutaway photographs show components, including details of hermetically sealed windings, six-shoe thrust bearing, expansion diaphragm, filter-check valve, control box. *Franklin Electric Co., Inc., Dept. HPAC, Bluffton, Ind.*

▶ *SUBSURFACE WASHER* — Development of subsurface washer used in demineralizers, Zeolite softeners, filters discussed in technical reprint T-139. Literature presents causes of bed fouling, problems encountered with installations in variety of industries. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

▶ *TIME SWITCHES* — Bulletin 356 describes time switches designed for use in economical hot gas, reverse cycle, electric heat defrosting, and for time, pressure, temperature control and compressor shutdown defrosting of 1 hr or longer. *Tork Clock Co., Inc., Dept. HPAC, Mt. Vernon, N.Y.*

▶ *TRANSFER SWITCHES* — New 16 page brochure, *Factors to Consider in the Selection of Automatic Transfer Switches*, is designed to simplify specification of this equip-

THE NEXT MEDICAL MILESTONE

. . . CONQUEST OF CANCER?

In a few short years we've seen the discovery of antibiotics, new wonder drugs for tuberculosis, a vaccine for polio. We will see the conquest of cancer, too, if people want it badly enough. Last year the American Cancer Society was unable to fill requests for research funds totalling almost $3,000,000. The reason—not enough money. Did you give all you could? Will you give all you can?

AMERICAN CANCER SOCIETY

smart solution
for efficient, low cost
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Here's the Acrovent "Threesome"—new Power Roof Ventilators designed or every commercial, industrial and institutional ventilating requirement.

model 53

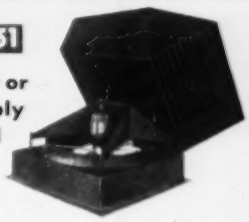
the new "low-level" design

Built-in quality and dependability. Free-action butterfly dampers open and close automatically; assure dependable all-weather protection. Sizes 12" to 48". Capacities to 41,000 CFM.

roof ventilators write for bulletin 600

model 51

exhaust or air supply model



Forces out stale, stagnant air or pulls in fresh, clean air. Serves as gravity ventilator when fan is not in operation. Conforms to modern plant design. Sizes 24" to 48". Capacities to 26,450 CFM.

model 40-a

Heavy-duty galvanized steel, with automatic dampers, for greater resistance to weather and corrosive atmospheres. Bolted construction increases strength; simplifies servicing. Sizes 12" to 72" for capacities to 80,000 CFM.

Also manufacturers of Aerovent "Macheta" Airfoil Axial Flow Fans • Blowers • Fan Wheels • Large Propellers • Make-up Air Units • Penthouses and Accessories • Special Equipment for Industry.

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Specify Raypak

Copper tube forced hot water boilers

...with exclusive gas modulation —sizes the boiler for the job!

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Complies with A.S.M.E. code

12 Models fit every need

Check these features

Raypak boilers are specifically packaged for Radiant Panel, Baseboard, Radiator, Convector, Swimming Pool and Volume Hot Water Supply Systems and also are ideal companions to Air Conditioning Units.

1. Original "Plug-in" Boiler
2. 100% copper waterways last a lifetime
3. Triple the BTU's per pound of weight
4. Remarkably compact and durable
5. Laboratory tested at 2,000 psi—no failure

Raypak's skilled and specialized distributors and representatives are available any time for consultation on any wet heating problem.

Raypak

RAYPAK COMPANY, INC.
Engineers-Manufacturers
2416 Chico Avenue
El Monte, California
Dept. H-6

Please send me additional information and name of local representative.

Name_____

Occupation_____

Company_____

Address_____

City_____ State_____

RECENT TRADE LITERATURE

Continued

ment. Lists 10 features required for adequate design, says company. *Automatic Switch Co., Dept. HPAC, 391 Lakeside Ave., Orange, N.J.*

▸ *TUBING* — Data card contains specification tables listing minimum values of normalized and drawn tubing. *Nikoh Tube Co., Dept. HPAC, 5000 S. Whipple St., Chicago 32.*

▸ *VALVE* — Circular No. 605 covers new bronze globe valve in 200 psi line. Addition of new line makes company's "LQ600" unit available in two series for wider range of applications. *Lunkenheimer Co., Dept. HPAC, Box 360, Cincinnati 14.*

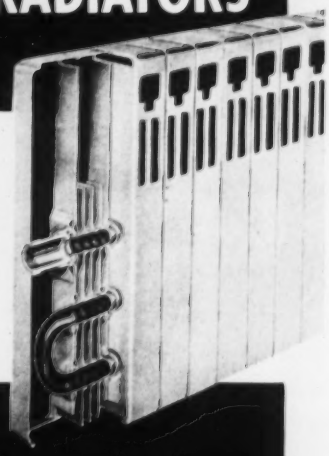
▸ *VALVES* — Eight page bulletin on company's line of valves includes 22 new models not previously announced. Tables show pipe sizes, listed ratings, other information. *A. W. Cash Valve Mfg. Corp., Dept. HPAC, 666 E. Wabash Ave., Decatur, Ill.*

▸ *WATER PRESSURE SYSTEM* — Reprint, *Keep Water Pressure Constant Through Pump Control*, describes water pressure system designed to be "inherently economical" in initial, maintenance, operating cost. *Automatic Control Co., Dept. HPAC, 995 University Ave., St. Paul 4.*

▸ *WATER SHOCK ABSORBER* — Catalog page 5549 lists features of "Quiet-Koil" shock absorber designed to stop water line hammer. Installation and operating instructions, specifications included. *Dormont Mfg. Co., HPAC, 5607 Butler St., Pittsburgh 1.*

▸ *WELDING* — New 140 page pocket data book TIS 2575 features simplified welding procedures for "every base metal." Book covers 120 welding rods, electrodes, welding compounds. *Eutectic Welding Alloys Corp., Dept. HPAC, 40-40 172nd St., Flushing 58, N.Y.*

SHAW PANEL RADIATORS



. . . designed for PROPER distribution of 2 kinds of heat

"Heat conditioning" a room requires 2 kinds of heat: *radiant* heat to warm solid objects, and *convected* heat, to warm the atmosphere.

Shaw Radiators deliver these two kinds of heat in unvarying, health-guarding proportions that only Nature, at her best, can duplicate. Shaw's exclusive AIR-e-ATED Radiant Heat is an engineered combination of radiant and convected heat that creates and maintains *natural* comfort in room areas.

AIR-e-ATED Radiant Heat is made possible by Shaw's completely self-contained design, which features full length steel heating fins and exterior radiant panels permanently bonded to the hot water or steam heating coils. Shaw-distributed heat is the standard by which we judge our individual comfort.

Write today for full information. And ask for your free copy of "Solving Modern Room Heat Distribution Problems".

SP-12

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. . . in

DU PONT

A Career Position for an

AIR CONDITIONING ENGINEER

The Engineering Service Division of du Pont's Engineering Department now has immediately available a challenging long-range position for a graduate engineer with 5 or more years experience in the selection and operation of heating, air conditioning, ventilating, and refrigeration equipment. The successful applicant will provide consultation to operating plants and to design and construction groups on the evaluation and economic operation of such equipment.

Duties will require a broad and detailed knowledge of heating methods and systems, fans, building heat transmission, automatic controls, air cleaning devices, spray apparatus, sorbent materials, refrigeration, air duct design, exhaust and conveying systems, drying systems, health aspects of ventilation, piping and insulation, instruments and measurements, and investment and operating costs.

CLEVELAND INTERVIEWS
Sun-Mon-Tues-Wed
June 17-18-19-20

To arrange an appointment with our technical representative, please call
Mr. J. C. Costello, Jr.
PRospect 1-6857

Or you may send complete resume, including details of education and experience, to:
Mr. J. C. Costello, Jr.
Engineering Department

DU PONT

Better Things for Better Living ...through Chemistry

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

How to put a GAS MASK on a BUILDING

"Dependence on outside air for ventilation can be the Achilles' Heel of Air Conditioning."

In many cities, smog and other air pollution is a growing problem. This hits hard at air conditioning, because ventilation traditionally depends on outside air. You must either draw contaminated air into the system, or shut it down during periods of peak contamination.

The Solution? Put a veritable "gas mask" on the building by use of Activated Charcoal FILTERFOLDS, a product of Barnebey-Cheney. Activated Charcoal FILTERFOLDS effectively remove smog and other air pollution, allow only fresh, clean air into the conditioning system. In a civil defense emergency such an Activated Charcoal air purification system could be a lifesaver.

Activated Charcoal FILTER FOLDS can work two ways: By filtering contaminated outside air, or by continuously purifying recirculated inside air. Either method can make a system almost independent of outside air condition. Write today for free technical literature.

BARNEBEY-CHENEY COMPANY

Columbus 19, Ohio — St. John's, Quebec

WRITE FOR free technical bulletins on Air Purification with Activated Charcoal FILTER-FOLDS

The BARNEBEY-CHENEY Company
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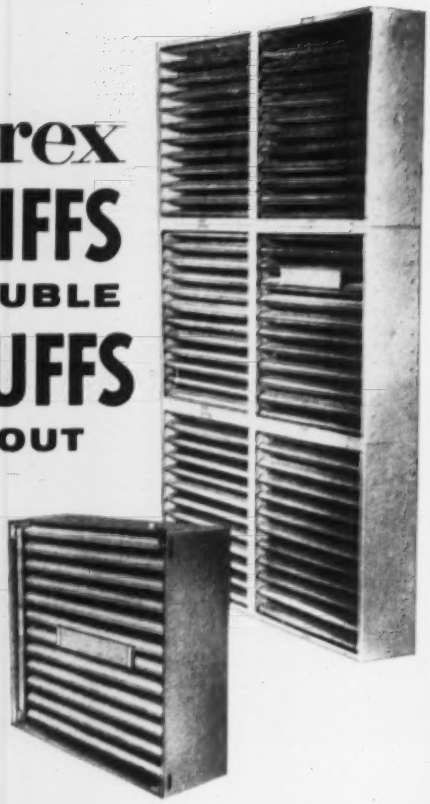
dorex SNIFFS TROUBLE SNUFFS IT OUT



● A maker of fine photographic printing papers was plagued by intermittent spoilage—evidently caused by some airborne impurity too dilute to be identified by any means of analysis at hand.

Connor engineers were called in as experts on air purification. They installed Dorex test equipment to determine the nature of the impurity. Later, these test units were analyzed in the Connor laboratory—revealing the cause of spoilage as minute quantities of phosphorus originating from a smelter some miles away.

As a result of these findings, Dorex Air Recovery "C" Cells were installed in the air conditioning system—and the spoilage stopped immediately.

This is one example of how Dorex Air Recovery can purify outside air for sensitive manufacturing operations. Equally important is the positive indoor protection Dorex can provide in areas where smog is a problem.

Special cases aside, Dorex Air Recovery in any air conditioning or ventilating system will substantially reduce (1) the needed amount of outside air, (2) the needed capacity for heating and cooling, (3) installation and operating costs. Write us for full information, Connor Engineering Corporation, Dept. A-66, Danbury, Connecticut.

CONNOR ENGINEERING CORPORATION

dorex® air recovery

WHO'S WHAT...

(New personnel, promotions)

▸ *FAIRBANKS, MORSE & CO.*—Newly elected officers: Robert H. Morse, III, vice president, sales; D. L. Harwood, vice president, purchases; J. F. Weiffenbach, director of engineering. Changes in factory and sales organization include: L. A. Weom, manager of pump sales division at Kansas City, Kan.; J. R. Walsh, manager of materials and schedules at Beloit works; G. R. Anderson, manager of Kansas City works; A. H. Hoffman, manager of Freeport, Ill. works; V. E. Johnson, manager of Westco Works in St. Louis.

▸ *SERVEL, INC.*—Newly elected directors are: W. F. Rockwell, Jr., president and director of Rockwell Mfg. Co.; A. Lightfoot Walker, executive vice president and director of Rheem Mfg. Co.; J. Patrick Lannan, partner in Kneeland & Co. A. A. Pieper has been named controller of the company.

▸ *YORK CORP.*—W. E. Landmesser, manager of sales for commercial and residential air conditioning products.

▸ *ACME INDUSTRIES, INC.*—Walter M. Hassenplug, director of engineering.

▸ *BORG WARNER CORP.*—Robert S. Ingersoll, president; Roy C. Ingersoll, re-elected board chairman, but relinquished presidency held for last six years; Lester G. Porter, executive vice president; Albert Steg, financial vice president and treasurer; Robert W. Murphy, given additional responsibility of vice chairman of executive committee; Paul A. Barkmeier, director of marketing services.

▸ *CRANE CO.*—Newly elected to board of directors are F. F. Elliott, L. H. T. Clegg and Anthony von Wening. John Adaska has been named assistant manager of company's heating department.

▸ *PENNSYLVANIA SALT MFG. CO.*—Dr. George McCoy, manager of research and development department; Joseph J. Duffy, Jr., manager of executive procurement and development; Arnold E. Blitz, appointed to technical sales staff to direct introduction of company's new line of refrigerants.

▸ *FAIRBANKS CO.*—E. T. Flanagan, a director. Mr. Flanagan is company's vice president of sales.

▸ *MITCHELL MFG. CO.*—Frank J. Scire, director of engineering; Louis DiGioia, chief mechanical engineer.

WHO'S WHAT

Continued

▶ *NATIONAL-U.S. RADIATOR CORP.* A. O. Willis, manager of manufacturing.

▶ *POCONO FABRICATORS, INC.* Don H. Rayburn, sales manager.

▶ *PREMIER CO.* C. A. Halverson, Jr., a director; Charles M. Cassidy, chief engineer; Warren J. Nelson, production manager; Harold H. Hegman, purchasing agent.

▶ *PULLMAN VACUUM CLEANER CORP.* Stanley Berns, chairman of the board; Robert Berns, president; John Danniell and Edgar Green, vice presidents.

▶ *PITTSBURGH PLATE GLASS CO.* Appointments within Fiber Glass Div. are: Robert A. McLaughlin, general manager; P. Dudley Kaley, manager of sales.

▶ *GENERAL ELECTRIC CO.* Francis R. Vanlandingham, manager, distribution development of Weathertron department. Managers of new sections within medium induction motor department are: Glenn A. Cook, low integral horsepower and wire mill products; Peter N. Guernsey and David H. Ware, manufacturing and engineering, respectively, for high integral horsepower products; George B. Woods, a-c specialty and atomic motor products; James H. Tyler, medium integral horsepower products. Kenneth E. Glover has been named specialist, operations research and synthesis for distribution assemblies department.

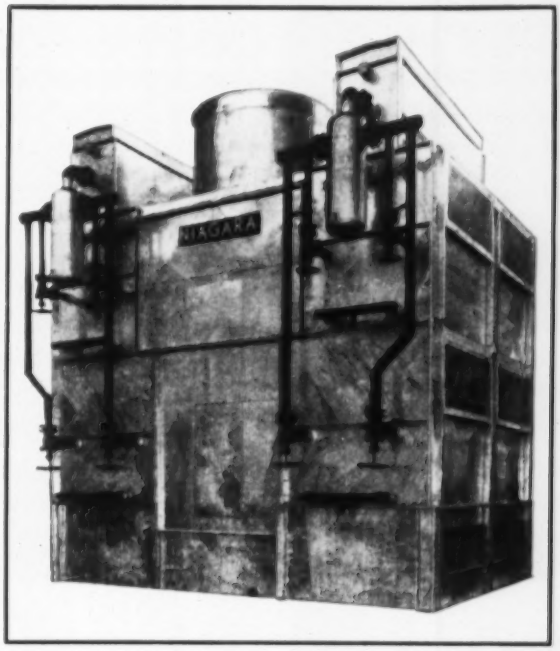
▶ *TRANE CO.* Albert Raitzer, added to staff of product engineering department as project engineer assigned to work on high temperature brazing and welding techniques.

▶ *E. H. TITCHENER & CO.* Russell F. Schreiber, executive vice president and treasurer; T. W. Whipple, vice president in charge of sales; Edward T. Wayne, vice president and director of engineering; Miss Elsie R. Schaefer, secretary.

▶ *HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATON* Frank C. Lawton, board member on the national joint board for settlement of jurisdictional disputes in the building and construction industry. Mr. Lawton is a partner in the mechanical contracting firm of Lawton & Kelly, Paterson, N.J.

▶ *McQUAY, INC.* J. R. Resch, a director. He succeeds P. S. Morris, retiring.

Large refrigeration plants save money with NIAGARA high efficiency condensers



In size ranges from 100 to 450 tons refrigeration Niagara's "Super" Condensers save power, save large cooling water and water handling expenses and help the user avoid most of the upkeep problems and troubles of a refrigerating plant. Always full condensing capacity is assured by the "Duopass" pre-cooling coils which remove the superheat and bring about condensing at low temperatures. Complete accessibility assures labor saving, inexpensive upkeep.

NIAGARA BLOWER COMPANY

Dept. HP, 405 Lexington Avenue

NEW YORK 17, N. Y.

District Engineers in Principal Cities

Write for complete information.

Ask for Niagara Condenser Bulletins 123 and 131. ▶

NIAGARA — *Over 40 Years' Service in Industrial Air Engineering*

WHO'S WHAT

Continued

▶ *MILWAUKEE VALVE CO.*—Frank Kovich, general manager. Mr. Kovich is also vice president of Controls Corp. of America and director of manufacturing of A-P Controls Div.

▶ *UTILITY APPLIANCE CORP.*—Stanley F. Skafte, director of engineering; Charles F. Cushing, director of sales for heating and air conditioning division; Richard J. Peterson, manager of research and chief engineer.

▶ *VIKING AIR PRODUCTS, DIV. OF NATIONAL-U.S. RADIATOR CORP.*—Robert M. Wolaver, appointed to American Society of Industrial Designers.

▶ *WAGNER ELECTRIC CORP.*—Newly elected officers are: J. C. Evans, controller; E. G. Holtzman, secretary-treasurer; J. P. Harbacek, assistant secretary and assistant treasurer.

▶ *WATER SERVICE LABORATORIES, INC.*—Gregory Gould, appointed to administrative engineering staff.

▶ *JOY MFG. CO.*—A. B. Drastrup, vice president.

▶ *WHIRLPOOL-SEEGER CORP.*—Lincoln M. Larkin, general manager of air conditioner division; George T. Stevens, director of merchandise development.

▶ *WORTHINGTON CORP.*—A. William Fraser and Clarence S. Wentworth, commercial vice presidents.

▶ *C. H. WHEELER MFG. CO.*—Clayton S. Coggeshall and Paul J. Doyle, directors.

▶ *WALWORTH CO.*—Dr. Carl Frederick Floe, a director.

▶ *MASTER FAN CORP.*—Philip J. Siegel, general manager. Mr. Siegel previously held the position of chief engineer.

▶ *BABCOCK & WILCOX CO.*—L. S. Wilcoxson, a director. Mr. Wilcoxson will continue to be in charge of company's boiler division.

▶ *BUENSOD-STACEY, INC.*—Milton S. Smith, president and chief executive officer. A. C. Buensod, chairman of the board; R. O. McGary, senior vice president in charge of sales.

SAVE WITH THESE STANDARD DESIGNS

Drawing on its long and varied experience in manufacturing heat exchangers, ADSCO has standardized the designs of many of its U-bend heaters and coolers. In this standardization program, production costs have been reduced, while the performance ability of the exchangers has been maintained. The result is high ADSCO value with the benefits of standardization passed along to customers.

TANK SUCTION HEATERS
Viscosity of heavy oils and other liquids is reduced by heating so they can be pumped economically. Only liquid to be pumped is heated, eliminating steam waste.

OIL PRE-HEATERS
Highest performance is obtained from fuel oil by heating it properly for complete combustion in burner. Work done by pre-heaters permits use of heavier grade, less costly fuel oil.

CONDENSATE COOLERS
As condensate coolers or waste-heat reclaimers, this equipment transfers otherwise wasted B.T.U.'s to other fluids which must be heated, thus effecting substantial savings.

STORAGE WATER HEATERS
Wide choice of tank materials offered, including solid or clad corrosion-resistant metals, or steel with phenolic resin lining. Of welded construction, in vertical or horizontal types. Removable heating elements of copper U-tubes.

INSTANTANEOUS WATER HEATERS AND CONVERTORS
For heating water for process work or for showers and washrooms. As convertors, these heaters are used for space heating. Of simple U-bend design with removable element.

ADSCO HEATERS AND COOLERS

AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

Custom Made

AIR DIFFUSERS with DIFFUSING VANES

Each AGITAIR square and rectangular air diffuser is custom designed to meet your requirements of air flow and interior treatment.

These AGITAIR diffusers have built-in diffusing vanes, scientifically arranged in unlimited louver patterns to provide certified 100% draftless air distribution from any ceiling or wall location.

AGITAIR Catalog R-107 shows you how to select the proper size and pattern for your job conditions.

Write for your copy today.

you can depend on AGITAIR for better air

AIR DEVICES INC.
185 MADISON AVE., N. Y. 16, N. Y.
air diffusers • filters • exhausters

HOW TO GET FUEL PUMP PERFORMANCE THAT CUTS MAINTENANCE COSTS

Install
TUTHILL TYPE SU *Pumping Units For Dependable Service in Industrial Heating*

Tuthill Type SU multiple V-belt pumping units provide structural and performance advantages for dependable, uninterrupted operation that add up to reduced maintenance expense.

Features like these make the SU outstanding for handling heavy fuel oils in industrial heating:

- ★ **Motors up to 5 h.p. mounted on slotted slide rails for easy adjustment or replacement. No drilling or tapping required.**
- ★ **Cast iron base with mounting bolts and adjustments easily accessible.**
- ★ **One-point belt-tension adjustment.**
- ★ **Jack shaft, supported by ball-bearing pillow blocks, carries entire weight of pulley and absorbs belt tension.**
- ★ **Pump, jack shaft and pillow blocks available as separate unit.**
- ★ **Pump and jack shaft direct-connected by flexible coupling for better alignment and simplified mounting.**
- ★ **Wide range of pump models and capacities.**

Complete data is presented in Tuthill Catalog No. 107. Write for your copy today.

TUTHILL PUMP COMPANY
Dependable Pumps since 1927
939 East 95th St., Chicago 19, Illinois
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

WHO'S WHAT

Continued

▸ *CLEAVER-BROOKS CO.*—Henry E. Little, general superintendent in charge of operations at plant under construction at Lebanon, Pa.

▸ *COMBUSTION ENGINEERING, INC.*—H. G. Ebdon, executive vice president.

▸ *TUBE TURNS*—John G. Seiler, appointed to the nuclear energy group of the Southern Regional Education Board sponsored by the Southern Governors' Conference. Mr. Seiler has just recently been elected president of Tube Turns.

▸ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE*—Newly elected officers are: Matthew M. Lawler, vice president of Worthington Corp., president; Lud Emde, president of Temprite Products Corp., vice president; C. E. Buchholzer, president of Airtemp Div., Chrysler Corp., treasurer.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *BRUNNER MFG. CO.*—George L. Hickey, Jr., sales representative in New York metropolitan area.

▸ *SEELYE, STEVENSON, VALUE & KNECHT*—Samuel C. Bast, associate of the firm.

▸ *SURFACE COMBUSTION CORP.*—J. R. Manier, sales manager of new Cleveland sales and engineering office.

▸ *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.*—Technical sales representatives and the territories they will cover are: Raymond B. Davis, east central United States; Bob L. Roberts, Philadelphia and surrounding area; Ralph E. Seaton, New York, New England, northern New Jersey; William R. Morrisey, Pittsburgh and surrounding area. Ralph C. Wells has been appointed sales representative for Van D. Clothier, Inc., Wolverine's far west outlet.

▸ *J. F. PRITCHARD AND CO. OF CALIFORNIA*—Ernest L. Graves Co., sales representative for Oklahoma.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—K. Kelly Keenan, San Francisco district sales manager for heating appliance controls division.

▸ *REFRIGERATION ENGINEERING, INC.*—Henry P. Graham, distributor for "Recold" air conditioning line in Florida; Z. M. Prane Co., a similar appointment for Chicago area.

Power-Flame and COMBI-MATIC

GAS CONVERSION BURNERS

Gas-Oil Combination Burners

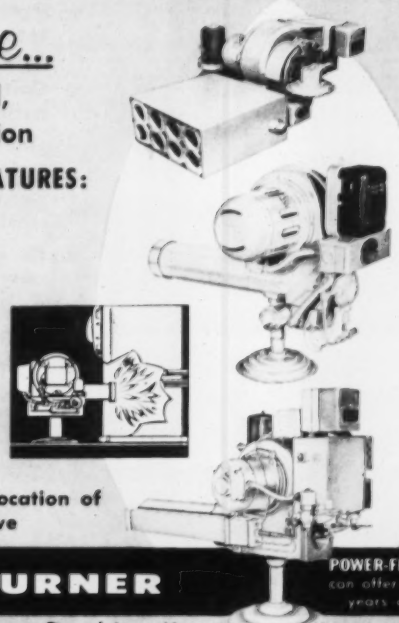
The Complete Line...

engineered for every industrial, commercial, domestic application

WITH ALL THESE IMPORTANT FEATURES:

- Completely assembled and factory wired
- 100% forced air for complete combustion
- Dimensional design permits installation without heating plant modification
- Fully approved safety controls
- Extremely simple to install and adjust for high efficiency and low operating cost
- A full line—priced right.

Write for complete information and the location of your nearest factory representative



BFG Series—
In capacities from 450,000 BTU to 18,000,000 BTU input. For industrial applications—large capacities for heating, power, or processing.

FG Series—
3 gun-type units in capacities from 175,000 BTU (AGA listed) to 500,000 BTU. Ideal for all conversion applications, especially for replacement of oil burners.

FGO Series—
COMBI-MATIC burners—forced draft gas-oil—6 models for all gases and light oil in capacities to 3,500,000 BTU input. U.L. listed. Changes over from one fuel to the other with automatic or "built in" manual switch.

Power-Flame BURNER

POWER-FLAME—regardless of application, you can offer your customer a burner that insures years of dependable trouble-free service

A Division of Siemon Manufacturing Company—Grandview, Mo.

REFRIGERATING ANATOMY

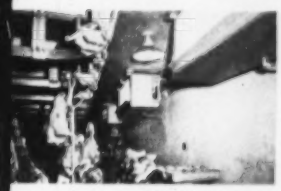
of a super SUPER MARKET!

Panorama #3 Market, Reseda, California

by DRAYER-HANSON

Installing Contractor: National Refrigeration Sales of Los Angeles, Inc.

2 SPOTAIRES — Meat Cutting & Packaging Rooms



4 HOT SHOTS — Meat Storage Room

2 SPASAVERS — Dairy Cooler

1 FLOCOLD — Beverage Cooler

Had the Full Story, yet, on product-produce storage and refrigeration?

D-H equipment has solved "tough nut" refrigeration problems — since 1910.

Request bulletins, XX-1

1 HOT SHOT — Ice Cream Freezer Room

PLUS . . . 10 more units, individually installed.

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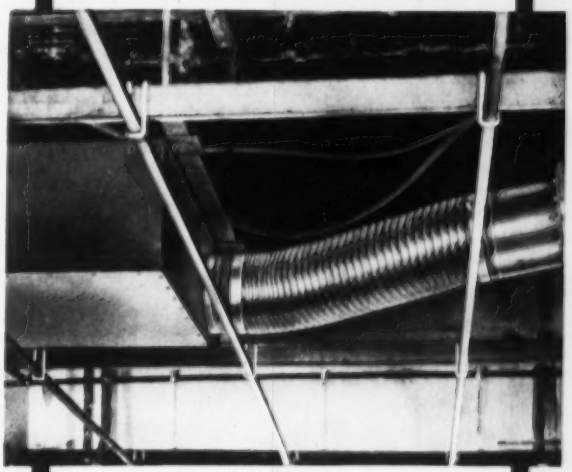
3301 Medford Street · Los Angeles 63, California

(Division of National-U.S. Radiator Corporation)

Branch connections are

EASIER



with

WIREMOLD *flexible* AIR DUCT

Bends easily without kinking

Wiremold Flexible Air Duct saves you TIME and LABOR • Connects air distributing units with branch ducts *easier* and *faster* • Solves misalignment problems • Allows for expansion and contraction of the system and prevents transmission of mechanical vibration • *Minimum waste* — short lengths quickly spliced on the job • *Lasts longer* — vinyl coated fiberglas fabric is *mechanically locked* into the strong steel spiral, eliminating glues or adhesives that dry out and crack.

Wiremold Flexible Air Duct meets the standards established by the National Board of Fire Underwriters.

There are Wiremold representatives in cities throughout the United States, Canada and Cuba.

The WIREMOLD Company

Hartford 10, Connecticut

WHO'S WHAT

Continued

▶ *GENERAL ELECTRIC CO.*—"Weathertron" distributors for Texas and the areas they will cover are: Wheeler-Rhodes Air Conditioning Co., McAllen area; Austin Air Conditioning Co., Inc., Austin area; Texas General Air Conditioning Co., Corpus Christi area; Kerr Lumber Co., San Antonio area.

▶ *GORTON HEATING CORP.*—R. C. Schneider, sales representative in Wisconsin, upper peninsula of Michigan; J. William Walter, to cover Michigan, exclusive of Detroit area and upper peninsula.

▶ *GENERAL CONTROLS CO.*—John A. Mitchell and John B. Hurd, field representatives for Chicago and Columbus factory branches, respectively.

▶ *WIREMOLD CO.*—Robert S. Dutton, appointed to sales force of air duct division to work with mechanical contractors on air conditioning and dust control duct problems.

▶ *OSTER MFG. CO.*—Ray Moulen, factory sales representative to cover New York City, western Connecticut; Allan MacKenzie, transferred to Chicago territory to cover Illinois, Wisconsin.

▶ *WORTHINGTON CORP.*—Charles D. Cummins, district manager of Seattle office.

▶ *POWERS REGULATOR CO.*—Newly appointed branch personnel are: Wayne Norin, manager, Milwaukee; Robert F. Cummings, manager, Omaha; Joseph H. Richards, resident engineer, Columbus; Charles E. Brandes, resident engineer, Dayton.

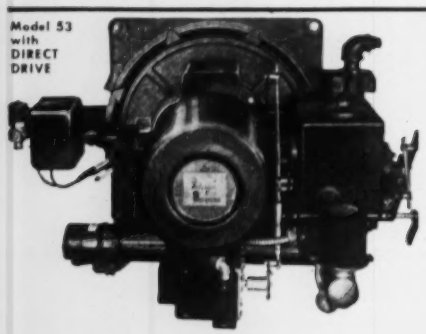
▶ *TRANE CO.*—Roger Burtness, manager of Billings sales office.

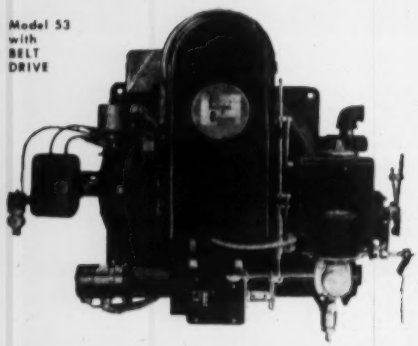
▶ *RUUD MFG. CO.*—F. F. Leonard Co., distributor for Toledo marketing area.

▶ *COCHRANE CORP.*—Cochrane Water Conditioning, Ltd., subsidiary of company to carry on engineering, manufacturing, sales activities in Canada.

▶ *CLARK CONTROLLER CO.*—Platt Electric Supply, Inc., distributor for Oregon, Washington, Idaho, Montana, Alaska, Hawaii.

▶ *NATIONAL-U.S. RADIATOR CORP.*—Promotions in southeastern states marketing staff are: Robert C. Seaton, district manager, southeastern district; John M. Newlon, Jr., Richmond branch manager, succeeding Mr. Seaton.





SETTING NEW STANDARDS OF PERFORMANCE

Positive "Cold Starts"
Higher Efficiency
Greater Economy

JOHNSON Model 53
METERING PUMP BURNERS

This revolutionary new Johnson "Fifty Three" will give you smooth, sure, automatic "Starts" even when the oil in storage tank and lines is cold and hard to pump. It is built with a positive-displacement Metering Pump . . . a 3-Way Magnetic Oil Valve . . . and a high-efficiency Suction Pump that enable the "Fifty Three" to maintain a fixed air-fuel-ratio regardless of variations in oil temperature and viscosity. It will start up and operate automatically on colder oils than any other burner on the market. Never before has any burner so successfully solved the "Cold Starts" problem.

It is available with either Direct Drive or Belt Drive in 8 sizes from 25 HP to 500 HP . . . with all the fine engineering that have made Johnson Burners famous for economy and high efficiency for over half a century. It's built with all working parts readily accessible for easy servicing, inspection or regulating. If you haven't seen it yet, make it a point to investigate this revolutionary new burner. May we send you a copy of our beautiful new Model Fifty Three brochure?

Johnson Oil Burners

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
Church Road, Bridgeport, Pennsylvania

Builders of fine Oil Burner Equipment since 1903

COMPLETELY AUTOMATIC COMFORT HEATING

Unattended uniform heat around the clock . . . . and the cost of heating is sharply reduced with an Olson Heater. Let an Olson representative show you the "black and white" facts on how your plant or warehouse heating can be improved while the cost is reduced.

STAINLESS STEEL

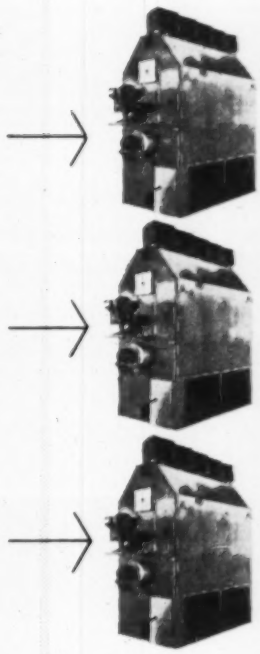
Combustion Chamber is constructed of AUSTENITIC STABILIZED stainless steel. It provides an effective gas travel pattern and reverse current through a band of boiler tubes in the economizer section.

RUGGED CONSTRUCTION

Built solid and tough, designed for easy maintenance. Free from vibration and quiet running. All important adjustments and controls are on the outside within easy sight and reach.

SEPARATE DRAFT FAN

An important feature that eliminates cold air blasts at every start — allows separate control between main blowing fans and exhaust.



Manufactured in a variety of sizes for gas, oil or dual gas and oil. The initial cost is low compared to complicated systems and there is nothing to freeze during extremely cold weather. Needs no attendant because it is completely automatic. The industrial styling is trim, neat and requires little floor space. After many years of service it's easy to disconnect and move to another location to be put back into service.

Other applications for the Olson S S are: make-up air, drying adaptations, high temperature and process work. Easily adapted to duct systems.

CAPACITIES
300,000
to
2,000,000
B.T.U. Output

GAS, OIL
OR DUAL
GAS & OIL

Olson

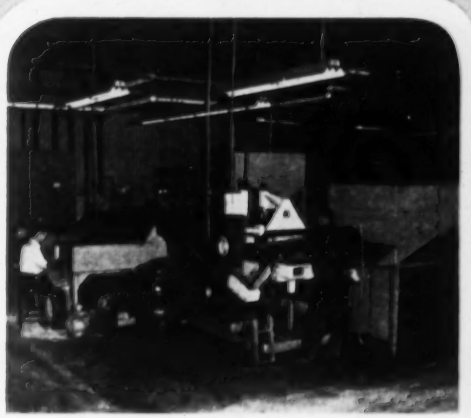
ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO
Representative in Principal Cities

"WITCH"

PIPE HANGERS

FOR

HEATING – PLUMBING POWER & PROCESS



The latest mass production methods are used to manufacture uniformly high quality pipe hangers and supports at the lowest cost to the customer.

Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

New compactness in air-cooled AIR CONDITIONER design!

Smallest air-cooled, self-contained (not remote) 5-ton central type unit made.

5 natural wood-grain finishes available on all free-standing models.

Completely automatic, thermostat controlled, air-cooled condenser.

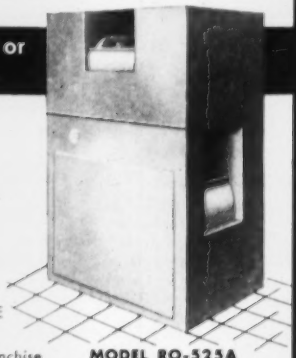
MODEL RO-525A
(with air distribution head)

MODEL NO.	NOMINAL CAPACITY	TOTAL COOL. B.T.U.	COOLING C.F.M.	OUTSIDE DIM.
FL-2	2 Ton	24,000	900 @ .3 S.P.	30Wx21Dx43H
RO-26	2 Ton	24,000	1000 @ .3 S.P.	30Wx21Dx34H
RO-31	3 Ton	36,000	1200 @ .2 S.P.	30Wx23Dx38H
RO-31 H.P.	3 Ton	37,700	1400 @ .3 S.P.	30Wx25Dx40H
RO-525 A	5 Ton	65,500	1800-2400 @ .3 S.P.	40Wx26Dx57H

Thermostat has 3 positions: Continuous – Automatic, Fan & Compressor – OFF.

Complete air conditioning for entire home — or equivalent commercial or office area — at the lowest cost in smallest space! GENERAL AIR CONDITIONERS deliver 2, 3 or 5 tons of cooling. All models operate on standard outlet (220 V, single and 3 phase except 2-ton — single phase only).

Attic, roof, outside, or free-standing units



NATIONWIDE SALES AND SERVICE

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WRITE today for details. Franchise dealerships available.

MODEL RO-525A
(without air distribution head)

Main Office

GENERAL AIR CONDITIONING CORP.

Dept. S-24 • 4542 E. Dunham St.
Los Angeles 23, California

FIVE YEAR GUARANTEE — easy payment plan

more indoor comfort, winter or summer!

Air comes in like a Lion

goes out like a Lamb

...with Standard Ceiling Air Diffusers and Baseboard Intakes!

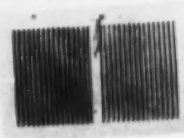
Standard's Ceiling Air Diffusers and Baseboard Intakes can supply a tremendous volume of air per outlet, without creating objectionable air motion. The Diffusers combine higher air induction rates with gentle distribution, for *full dimension comfort*. The Intakes provide draft-free air return. The result is more solid indoor comfort, winter and summer!

STANDARD

... first in engineering for indoor comfort!

MAIL COUPON TODAY FOR NEW FREE CATALOG OF THE COMPLETE STANDARD LINE!

CEILING AIR DIFFUSERS
Flush or Extended Models, also dampers and installation rings. For 6" – 14" ducts. Beautiful tan metallic finish.



BASEBOARD INTAKES
42H or 32V, with horiz. or vert. adjustable bars. All sizes ½" projection all sides for easy installation, smart styling.

STANDARD STAMPING & PERFORATING CO.
3125 W. 49th Place Chicago 32, Illinois

Gentlemen: Please send me your new catalog showing Standard's complete line of registers and grilles.

Name _____

Company _____

Address _____

City _____ Zone ____ State ____

WHO'S WHAT

Continued

▸ *TAPECOAT CO.*—Tay Holbrook, Inc., northern California distributor; Palmer Supply Co., to handle sales and service in Northwest.

▸ *CONNOR ENGINEERING CORP.*—W. A. Crowder, representative for line of ceiling diffusers for Washington, Oregon, Idaho.

▸ *AIRTEMP DIV., CHRYSLER CORP.*—Martin A. Prince, room air conditioner district manager, Dallas region.

▸ *MUELLER CLIMATROL*—Robert A. Breese, named sales promotion manager of Rodgers Engineering Co., Mueller's north Texas distributor.

▸ *DRAYER-HANSON, INC.*—Bradbury-Kenrick Assoc., factory representative for industrial division in Detroit area.

▸ *L.O.F GLASS FIBERS CO.*—George R. Frick, Syracuse district sales manager; George C. Arnold, field representative in Boston area, the post previously held by Mr. Frick.

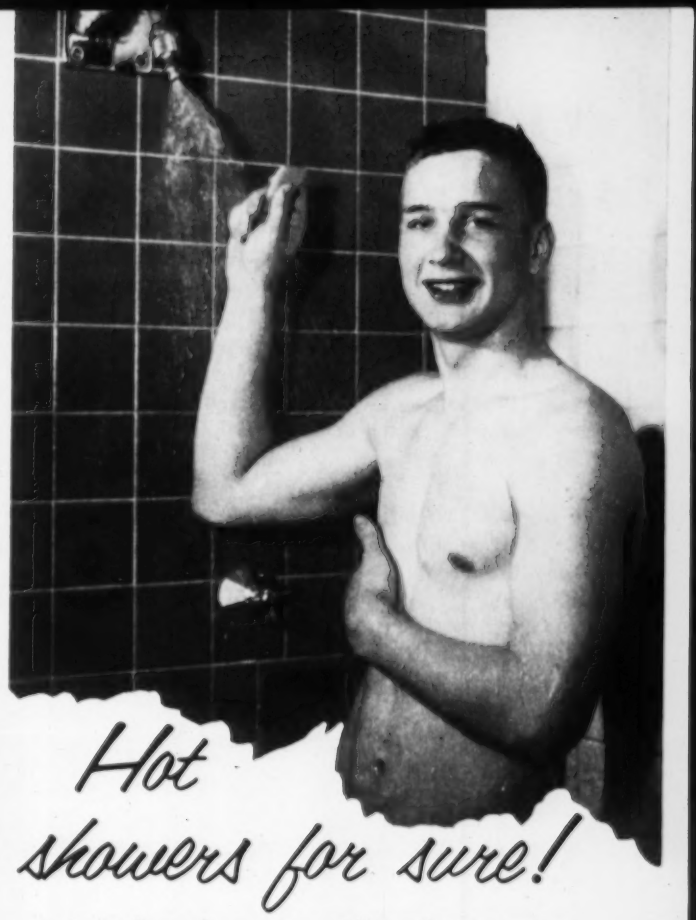
▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—Frank Neal, western market manager for schools in 13 western, mountain, southwestern states; Robert J. Hoefer, branch commercial sales manager in Cincinnati office; Richard Beaubien, promoted to similar post in San Francisco.

▸ *McDONNELL & MILLER, INC.*—Eugene Mitchell and James W. Platt, regional sales managers, with headquarters in Chicago; Fred Rohe, district manager for Indiana, western Kentucky.

▸ *FRED H. SCHAUB ENGINEERING CO.*—Noah L. Simmons, industrial representative in Indiana, excepting Lake and Porter counties.

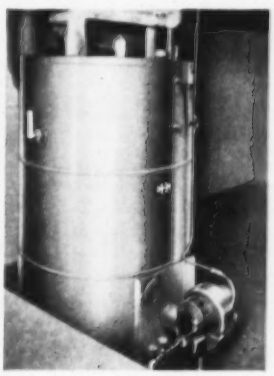
▸ *RELIANCE ELECTRIC & ENGINEERING CO.*—Assignments as sales engineers are: T. R. Mahoney, Newark; F. G. Griswold, Cincinnati; L. L. Saward, Baltimore; J. R. Peramplo, Detroit.

▸ *DIEHL MFG. CO.*—James E. Ramsay and Ralph C. Routsong, Jr., fan merchandising specialists for Chicago and Philadelphia areas, respectively; T. R. Banks, a similar appointment, to cover the Carolinas: Georgia, Tennessee, Alabama.



Hot showers for sure!

at school gym—thanks to a MT. HAWLEY WATER HEATER

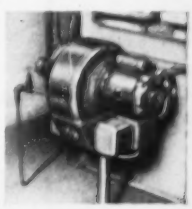


THE PROBLEM was how to supply plenty of hot water for showers at this high school gymnasium, DePue, Ill., during mild weather without firing up the large boiler used for heating. Because of its high efficiency, this water heater is used throughout the year.

THE SOLUTION was this Mt. Hawley AG-300 direct-fired, galvanized water-heater. Little floor space was required for this oil-fired unit—yet it has a recovery rate of 1200 gph at 100° F. rise from 40° to 140° and a storage capacity of 265 gal.

For a wide range of commercial hot water needs the Mt. Hawley AG Series water heaters are the perfect answer. They're compact, efficient—ready to provide low-cost hot water for hospitals, schools, laundries, service stations, restaurants, small industrial plants, motels and other buildings.

HEATING REQUIREMENTS for the gym were also solved by Mt. Hawley—an electronic G-8 Burner (15 gph) installed in a steel boiler. The Mt. Hawley G-8—highly popular light oil, high pressure, gun-type burner—was completely equipped with electronic controls and delayed-action fuel supply. *There's a Mt. Hawley burner for every heating job.*



Today—write, wire or phone Peoria 2-5448 collect for free literature and prices—at no obligation.

MT. HAWLEY MFG. CO.

Dept H-6 Routes 174 & 88 Peoria, Illinois

WE HEAR THAT...

▶ With the installation of its own copper mill, *HALSTEAD & MITCHELL* becomes one of the nation's most completely equipped and tooled manufacturers in the air conditioning and refrigeration industry, according to *BYRON HALSTEAD*, senior partner in the firm. Installation of a new extrusion press, draw benches, annealing facilities, and auxiliary equipment raises the company's production capacity for processing copper tubing and brass shapes from 4 million to 30 million lb per year, he continues.

▶ *C. A. DUNHAM CO.* and *BUSH MFG. CO.* have favorably considered a proposal contemplating the consolidation of their business into a new company. Under the proposal a new corporation to be known as *DUNHAM-BUSH, INC.* would be formed. The plan will be submitted to stockholders of both companies for approval.

▶ Recently, *MASON-NEILAN REGULATOR CO.* became a division of *WORTHINGTON CORP.* The division will retain its Norwood, Mass., address.

▶ *SOCIETY OF THE PLASTICS INDUSTRY, INC.* has relocated its headquarters to new offices at 250 Park Ave., New York 17, as of May 1.

▶ *NATIONAL CONSTRUCTORS ASSOCIATION* has awarded five safety awards to member companies. Companies which received the awards are: The Chemical Construction Company; The M. W. Kellogg Company; Koppers Company, Inc.; Procon, Incorporated; and The Rust Engineering Company.

▶ *L.O.F GLASS FIBERS CO.* has leased a 15,000 sq ft building and a 75 × 200 ft lot at Burbank, Calif. With the ideal weather conditions existing in Southern California, tools, dies and fixtures can now be stored in the open area, thus making more of the under-cover space available for direct manufacturing, says the company.

▶ *OHIO ELECTRIC MFG. CO.* has acquired KINGSTON-CONLEY, *INC.* as a wholly owned subsidiary. Present personnel and staff will be retained, and patents, trademarks, tools, dies, inventory and plant manufacturing facilities were included in one transaction. Kingston-Conley produces motors from 1/3 to 5 hp.

▶ *TRANE CO.* is employing a two-way radio network to be used exclusively by the company's centralized trucking department. The department uses the system to coordinate its activities within and between six La Crosse plants and several warehouses, comprising about three-quarter million square feet of floor space.

BISON

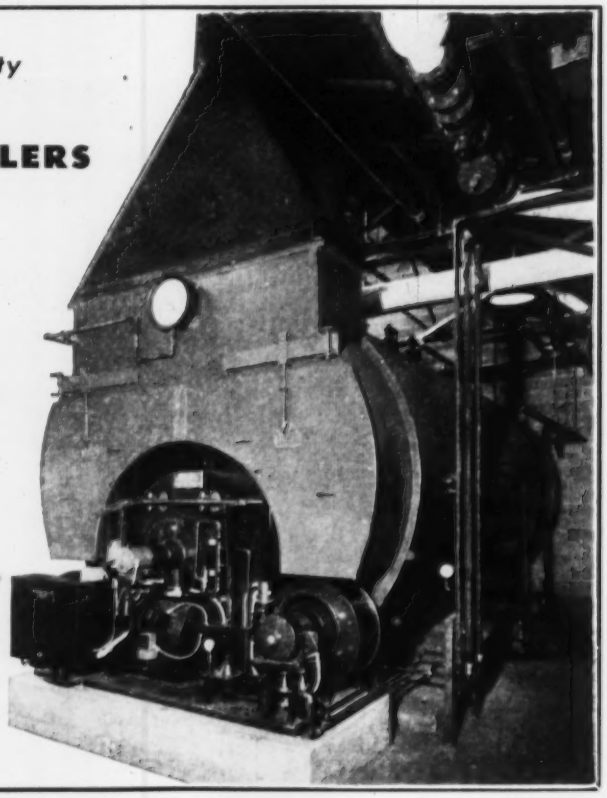
Dependable quality since 1863 . . . . .

POWER BOILERS

Throughout 93 years, Farrar & Trefts has been a leader in boiler design and construction. Today, as in yesteryear, F & T offers dependable, efficient, modern power boilers to satisfy the ever-increasing demands of institutional, apartment, office and industrial buildings. Under the same BISON brand, F & T also furnishes low-pressure boilers for heating purposes.

Proper selection of a boiler for the continuous delivery of required heat and power is a precise project, demanding the systematic approach of engineers long trained in this work. Engineers at F & T have this background of service and they welcome opportunities to evaluate the needs of boiler users.

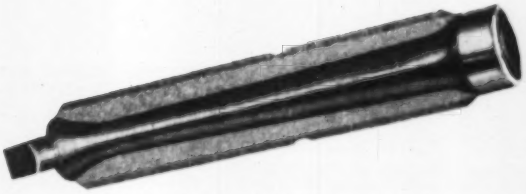
Standard F & T Suber Scot Power Boiler (150 lb. design pressure) with "Indiana Pack" burner at Mastic Asphalt Corp., South Bend, Ind. Furnished by Page Associates of Chicago. The Austin Co. were the Engineers and Contractors.



FARRAR & TREFTS DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

Webster

provides quality plus in the WEBSTER KINETIC®



At no increase in cost to you, the Venturi tube and flame retention nozzle unit of the famous WEBSTER KINETIC® now is fabricated from steel. Longer life and smoother operation is assured from a lighter weight unit.

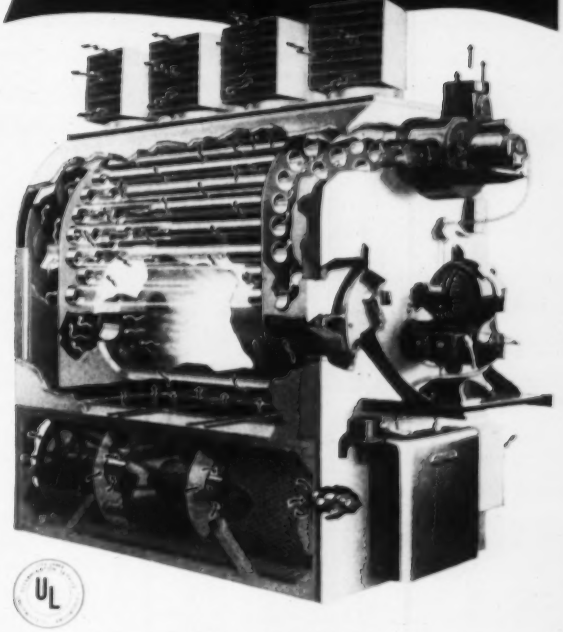
The heavy gauge chrome alloy nozzle is also standardized on the ROTONETIC and HC DYNETIC units.

This is just another example of Webster's ability to engineer and manufacture a more efficient and economical "tool" for burning gas. In its class no other commercial or industrial burner can compare cost wise with quality.

The
WEBSTER ENGINEERING *Company*
TULSA 1, OKLAHOMA

Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

Commercial-Aire



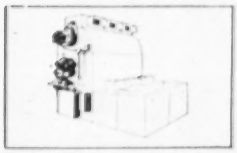
UL

DIRECT-FIRED

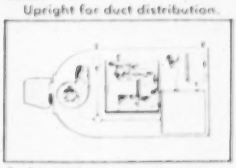
Space Heaters

300,000 BTU's
TO 2,000,000 BTU's

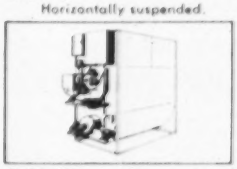
Provides industry with lowest cost heating. Primary cylindrical stainless steel combustion chamber, secondary heat-extracting tubes, consistent rate of combustion gas flow provide high efficiency, utilizing 80% of available heat of fuel. Highly adaptable to desired mounting arrangements. Features low first cost, easy maintenance, complete accessibility to all service points. Completely equipped and wired with controls for economical installation.



Series "FD"
Upright for duct distribution.



Series "H"
Horizontally suspended.



Series "U"
Inverted suspended.

Series "HD"
Horizontally for duct distribution.

MAMMOTH FURNACE CO.
6425 Cambridge St.
Minneapolis, Minn.

Send full details, prices, delivery dates, etc., on Commercial-Aire Heaters.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

WE HEAR THAT

Continued

▶ *JOHNS-MANVILLE CORP.* plans to build a new plant near Stockton, Calif. to manufacture "Transite" asbestos-cement pipe products. The plant will cover about 225,000 sq ft of operating space. In another West Coast area expansion move, the company announced that it had signed an option on a large gypsum deposit near Las Vegas and is considering entering the gypsum business.

▶ *WILLIAMS DIV., EUREKA WILLIAMS CORP.'s* three "Dealerama" caravans, each of which carried more than 25 pieces of heating equipment, have concluded tours covering a total of 11,293 miles in reaching dealers, builders and officials in the utility industry, the company announces.

▶ *BALDWIN-HILL CO.* is opening a new research laboratory devoted to the development of mineral wool insulations at its main plant in Trenton, N. J.

▶ Trade association officials, contractors, architects and builders were present when *FRANK F. ELLIOTT* and Walt Disney dedicated the *CRANE CO.* exhibit in the Tomorrowland section of Disneyland recently.

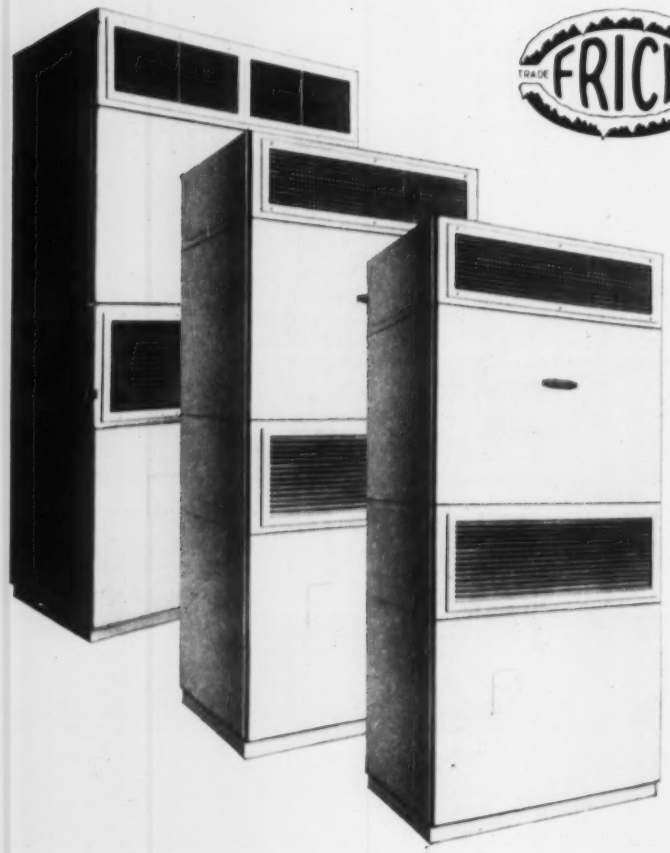
▶ A year's modernization program at the Buffalo plant of *ALLEGHENY LUDLUM STEEL CORP.* has recently been completed. The program was designed to make the plant more competitive by increasing production, giving quicker deliveries and controlling product quality, company officials report.

▶ Production of copper and copper alloys in the last quarter of 1956 by *AMERICAN BRASS CO.'s* $15 million brass mill at Los Angeles is predicted by company officials. The plant is expected to be at capacity operation by April 1957.

▶ The *ASSOCIATION FOR APPLIED SOLAR ENERGY* recently made initial world distribution of its newsletter, *The Sun at Work*. The quarterly publication is designed to establish and maintain contact among persons concerned with solar energy research.

▶ Ground has been broken for a new plant addition at *AUTOMATIC CONTROL CO.*, St. Paul. This new unit, the third and largest addition during the past six years, will increase floor space by 23,000 sq ft. Completion is scheduled for July.

▶ *D. K. CRAMPTON*, director of research and development, *CHASE BRASS & COPPER CO., INC.*, will present the fifth Gillett Memorial Lecture at the



FRICK TRADE MARK

Unit Air Conditioners

Have built into them 50 years' experience in conditioning air, 74 years' experience in refrigeration, and 103 years of successful engineering. Frick unit air conditioners installed in 1938 are still in service—and good for a long time to come.

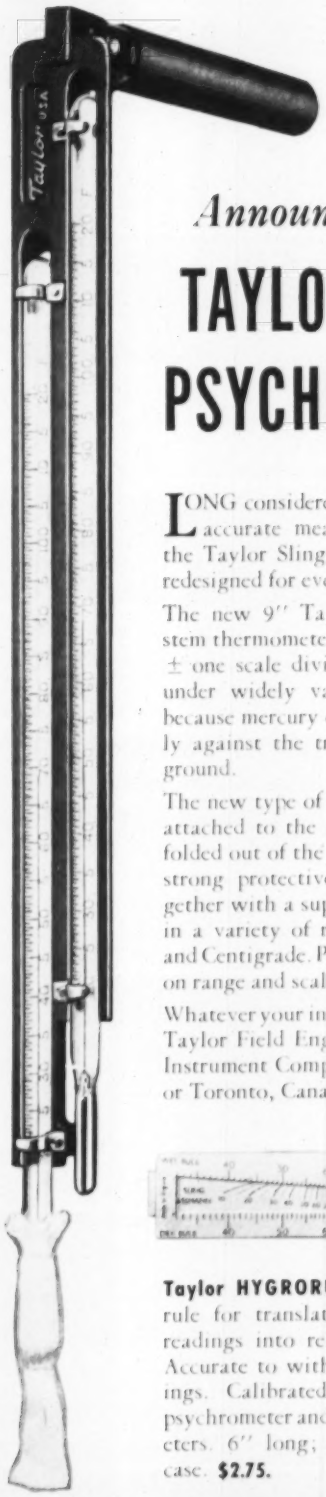
These superior units are furnished in sizes of 3, 5 and 7½ hp. They have heavier (quieter) cabinets, well insulated; larger cooling surfaces; insulated condensers; conservative ratings; and many other advantages. All are shown in Bulletin 522. Your copy is waiting: write today.

Some desirable territories still open for qualified Distributors.

DEPENDABLE REFRIGERATION SINCE 1853

FRICK CO.

WAYNESBORO, PENNA. U.S.A.



Announcing a new

TAYLOR SLING PSYCHROMETER

LONG considered the basic standard for accurate measurement of humidity, the Taylor Sling Psychrometer has been redesigned for even simpler operation.

The new 9" Taylor Gold Back etched stem thermometers are accurate to within ± one scale division. They can be read under widely varying light conditions because mercury columns stand out clearly against the translucent golden background.

The new type of swivel handle is rigidly attached to the metal back, and can be folded out of the way when not in use. A strong protective case is provided, together with a supply of wicks. Available in a variety of ranges, both Fahrenheit and Centigrade. Price **$10** to **$15** depending on range and scale calibration.

Whatever your instrument needs, call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor HYGRORULE. A convenient slide rule for translating wet and dry bulb readings into relative humidity values. Accurate to within ± 1% of table readings. Calibrated both sides for sling psychrometer and wall mounting hygrometers. 6" long; genuine leather pocket case. **$2.75.**

Taylor Instruments
MEAN ACCURACY FIRST

FLEXIFLO

The Diffuser for Every Application

Here's the complete diffuser line with all extra features: built-in equalizing deflectors; easy to install; quick adjustment of air volume and diffusion pattern; simplified engineering; beautifully finished in any color baked enamel.

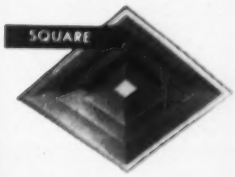
Let our sales engineers show you why Flexiflo is better for your jobs. But first — get the Flexiflo catalog.

Type R, constant flow pattern regardless of volume adjustment.

Type V, fully adjustable air diffusion pattern and volume.

Type MP, for 1-, 2-, 3- or 4-way diffusion to accommodate any shaped area, 16 styles.

Type CH, adjustable for heating, ventilating and cooling.



Type H, adjustable volume, constant pattern and radius of diffusion.

Type S, side wall or ceiling, with Type R or V blades for heating or cooling.

Return this coupon

FLEXIFLO

UNIVERSAL DIFFUSER CORP.
38 Marbledale Road, Tuckahoe, N. Y.

Please send me complete catalog MP

NAME

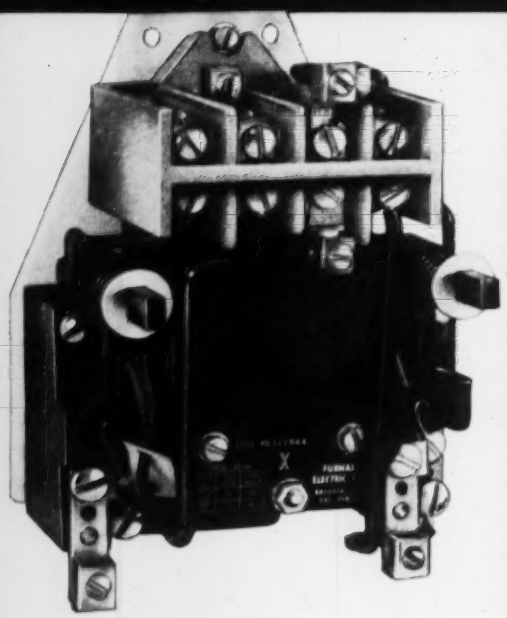
COMPANY

STREET

CITY ZONE STATE

FURNAS ELECTRIC CONTROLS

do the best job for AIR CONDITIONING and REFRIGERATION



MAGNETIC CONTROLS FOR HERMETIC UNITS

As original and replacement controls for air conditioning and refrigeration units, these compact magnetic controls are available in ratings of 20, 30, 35 and 50 amperes sizes and are listed as standard by Underwriters' Laboratories. Also available is a complete line of magnetic control for open type compressor units for applications through 200 hp.

Write today for Air Conditioning Bulletin 5410, 1041 McKee Street, Batavia, Illinois.

FURNAS

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

Sales Representatives in all Principal Cities

WE HEAR THAT

Continued

59th annual meeting of the *AMERICAN SOCIETY FOR TESTING MATERIALS* at Atlantic City on June 19. His subject is Structural Chemistry and Metallurgy of Copper.

▶ A new sound and color motion picture, "Zinc Controls Corrosion," has been produced by *AMERICAN ZINC INSTITUTE*. The 16 mm film, which has a running time of about 35 min, presents a demonstration of the general mechanism of corrosion as well as how zinc controls it.

▶ *FOSTER WHEELER CORP.* is recipient of a 1955 safety award presented by National Constructors Association. The award is given annually to companies which establish safety records based on frequency and severity of injuries lower than the association average.

▶ A modern factory for manufacture of induction motors was unveiled in Schenectady recently by *GENERAL ELECTRIC CO.*'s medium induction motor department. The facility was built at a cost of approximately $7 million.

▶ *GRIP NUT CO.* has moved its Chicago sales offices to new and larger quarters in the main plant at South Whitley, Ind.

▶ *GENERAL CONTROLS CO.* has completed a new building in San Francisco that increases the company's facilities in that city by 120 percent. Of modern, functional design, the showroom and warehouse encompass 4100 sq ft.

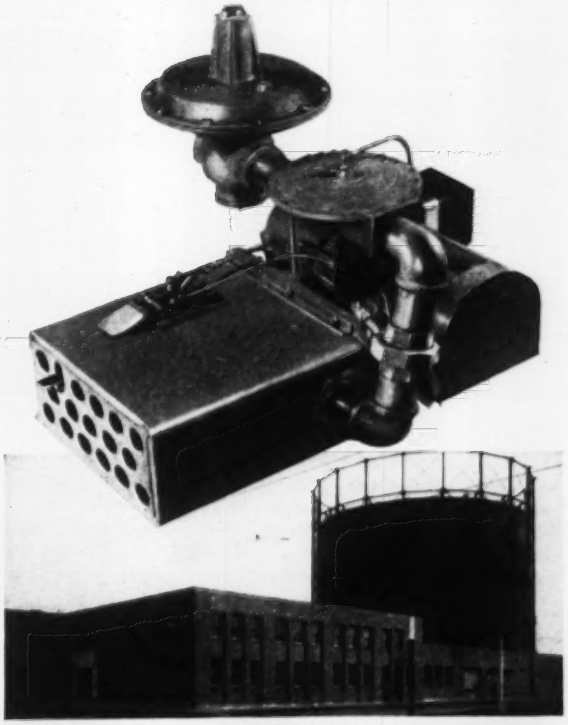
▶ Construction by *CARRIER CORP.* of a $6 million West Coast plant for the production of air conditioning equipment, furnaces and water heaters will begin this year. With an area of over 500,000 sq ft, the new manufacturing, engineering and office facilities will be located on a 68 acre plot at Puente, Calif.

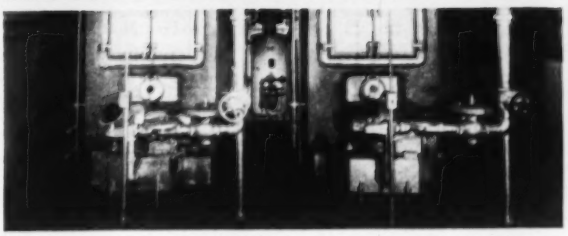
▶ The move to occupy its newly constructed plant in Milford, Conn., is being completed by *BRIDGEPORT THERMOSTAT DIV., ROBERTSHAW-FULTON CONTROLS CO.* Official dedication and opening ceremonies are planned for sometime this month.

▶ A "Name the Baseboard" contest, offering a total of 31 prizes to officers and employees of any company regularly engaged in selling and installing heating equipment is being held by *SLANT-FIN RADIATOR CORP.* The object of the contest is to name Slant-Fin's new $\frac{3}{4}$ in. baseboard radiator package. Complete details are available from the company.

LO-BLAST

THE POWER BURNER Gas Men Choose





Two 2,800,000 BTU Lo-BLAST Burners in service shop building of Peoples Gas Light & Coke Co., Chicago, Illinois. In addition, a Lo-BLAST Economite is used for water heating.

Lo-BLAST costs 10% less to operate—less to install

This burner uses an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air—always independent of natural draft—more efficient and dependable.

A high chimney is not needed and complete factory assembly reduces installation costs. Inshot design reduces maintenance. Each unit is factory tested on gas.

Capacities from 75,000 to 20,000,000 BTU input.
Write for engineering data.

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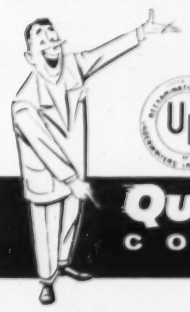

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MEETINGS & CONVENTIONS

JUNE 11-15—*Electrostatic Precipitation Seminar.* Pennsylvania State University. Chairman: R. E. Armington, assistant professor of electrical engineering. Pennsylvania State University, University Park, Pa.

JUNE 11-15—*21st National Oil-Heat Show.* Coliseum, New York. Managing director: R. H. L. Becker, Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36.

JUNE 11-15—*Seventh National Plastics Exposition.* Coliseum, New York. Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36.

JUNE 17-21—*American Society of Mechanical Engineers,* semi-annual meeting. Hotel Statler, Cleveland. ASME headquarters: 29 W. 39th St., New York 18.

JUNE 17-22—*American Society for Testing Materials.* Chalfonte-Haddon Hall, Atlantic City. ASTM headquarters: 1916 Race St., Philadelphia 3.

JUNE 18-20—*American Society of Heating and Air-Conditioning Engineers, Inc.,* semi-annual meeting. Shoreham Hotel, Washington, D.C. ASHAE headquarters: 62 Worth St., New York 13.

JUNE 17-21—*American Society of Mechanical Engineers,* semi-annual meeting. Statler Hotel, Cleveland. Headquarters: 29 W. 39th St., New York 18.

JUNE 21-23—1956 *Heat Transfer and Fluid Mechanics Institute.* Stanford University. General chairman: S. J. Kline, Mechanical Engineering Department, Stanford University, Stanford, Calif.

JUNE 25-26—*National Atomic Energy Conference.* Sponsored by the Atomic Industrial Forum, Inc. and the Denver Research Institute, Denver, Colorado. Information: Conference Committee, Denver Research Institute, University of Denver, Denver 10.

JUNE 25-29—*American Society for Engineering Education,* annual meeting. Iowa State College, Ames. Secretary: W. Leighton Collins, University of Illinois, Urbana.

JUNE 26—*Thermoplastic Structures Div. of the Society of the Plastics Industry.* Roosevelt Hotel, New York. Information: Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36.

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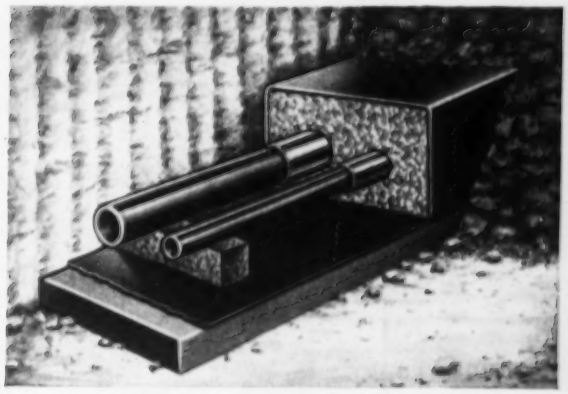

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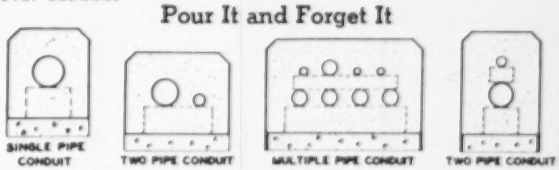

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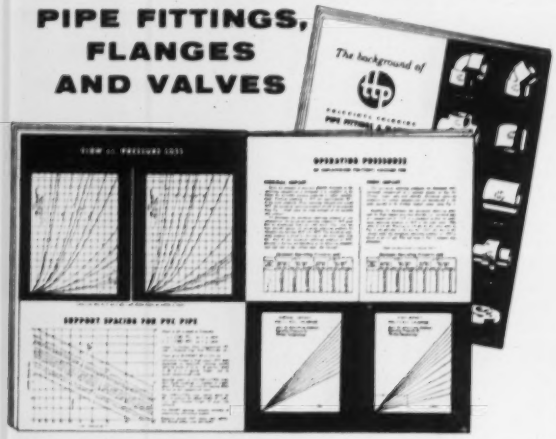

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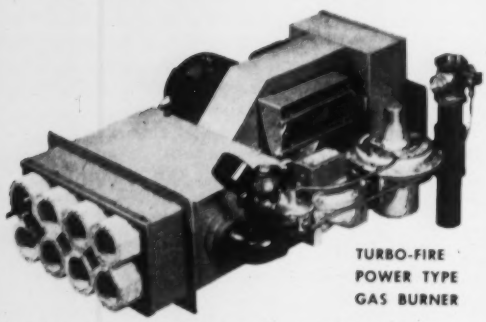

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MEETINGS & CONVENTIONS *Continued*

SEPT. 10-12—*The American Society of Mechanical Engineers*, fall meeting. Denver. ASME headquarters: 29 W. 39th St., New York 18.

SEPT. 17-21—*11th Annual Instrument-Automation Conference and Exhibit*. Coliseum, Columbia University, and Hotels Statler and New Yorker, New York. Sponsored by Instrument Society of America. Exhibit office: 250 W. 57th St., New York.

SEPT. 24-28—*Trade Fair of the Atomic Industry*. Navy Pier, Chicago. Conference Headquarters, Morrison Hotel, Chicago. Information: Dan Scherer, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

SEPT. 25-27—*Third Annual Forum Conference*, "Management and Technology for the Atomic Industry." Morrison Hotel, Chicago. Information: D. J. Scherer, Atomic Industry Forum, 260 Madison Ave., New York 16.

OCT. 1-3—*Heating, Piping and Air Conditioning Contractors National Association*, fall board of directors meeting and secretaries' conference. Hotel Statler, Detroit. Headquarters: Room 210, Shoreham Bldg., Washington 5, D.C.

OCT. 1-3—*National Electronics Conference*, 12th annual meeting. Hotel Sherman, Chicago. Information: Victor J. Danilov, Illinois Institute of Technology, Chicago 16.

OCT. 1-5—*National Association of Corrosion Engineers*, south central regional meeting. San Antonio. NACE headquarters: 1061 M&M Bldg., Houston 2, Texas.

OCT. 8-12—*American Welding Society*, fall technical meeting. Hotel Cleveland, Cleveland. Headquarters: 33 W. 39th St., New York 18.

Week of OCT. 12—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 22-24—*American Standards Association*, 38th annual meeting in conjunction with Seventh National Conference on Standards. Hotel Roosevelt, New York, N.Y. Headquarters: 70 E. 45th St., New York, N.Y.

OCT. 22-26—*44th National Safety Congress & Exposition*. Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

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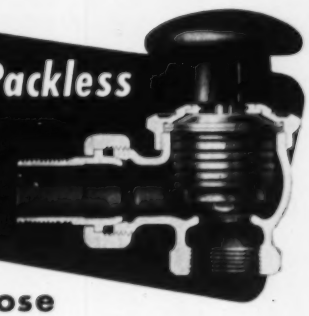

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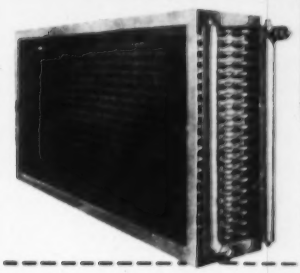

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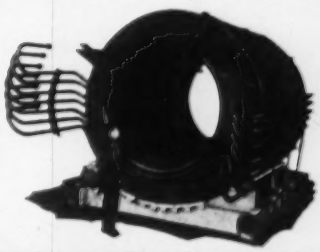

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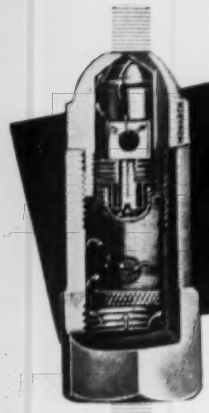

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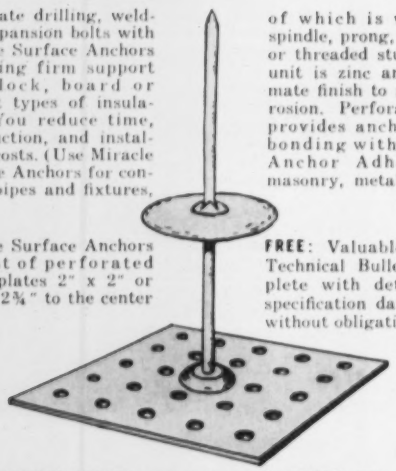

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MEETINGS & CONVENTIONS *Continued*

OCT. 24-27—*Air-Conditioning and Refrigeration Wholesalers*, annual meeting. Jung Hotel, New Orleans. Headquarters: 2607 N. High St., Columbus, Ohio.

OCT. 29-*NOV.* 2—*National Association of Practical Refrigerating Engineers, Inc.*, annual convention. Statler Hotel, Detroit. Headquarters: 435 N. Waller Ave., Chicago 44.

NOV. 15-18—*Refrigeration Service Engineers Society*, annual convention. Kansas City, Mo. Headquarters: 433 N. Waller Ave., Chicago 44.

NOV. 18-21—*10th Exposition of the Air-Conditioning and Refrigeration Industry*. Navy Pier, Chicago. Headquarters: 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 25-28—*American Society of Refrigerating Engineers*, semi-annual meeting. Boston. Information: ASRE, 234 Fifth Ave., New York 1.

NOV. 25-30—*American Society of Mechanical Engineers*, annual meeting. Statler Hotel, New York. ASME headquarters: 29 W. 39th St., New York 1.

NOV. 26-28—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Balmoral Hotel, Miami Beach. RACCA headquarters: 10660 Carnegie Avenue, Cleveland 6.

NOV. 26-30—*22nd National Exposition of Power and Mechanical Engineering*. Coliseum, New York. Under auspices of American Society of Mechanical Engineers. Manager: E. K. Stevens, care of the Exposition, 480 Lexington Ave., New York 17.

NOV. 27-30—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Conrad Hilton Hotel, Chicago. NWAHACA headquarters, 640 Engineers Bldg., Cleveland 14.

FEB. 25-*MAR.* 1, 1957—*International Heating & Air-Conditioning Exposition*. International Amphitheater, Chicago. Under auspices of American Society of Heating and Air-Conditioning Engineers, in conjunction with its 63rd annual meeting, also at Chicago. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13. ≠

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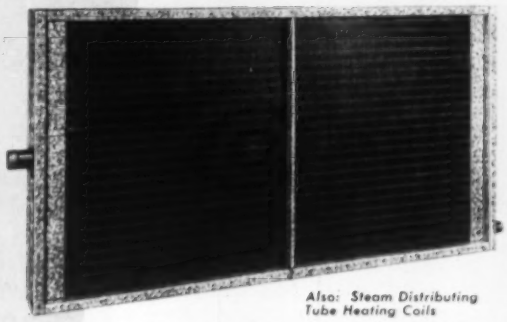

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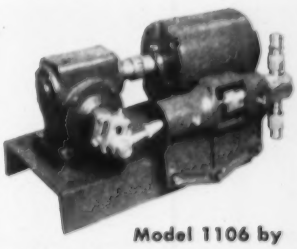

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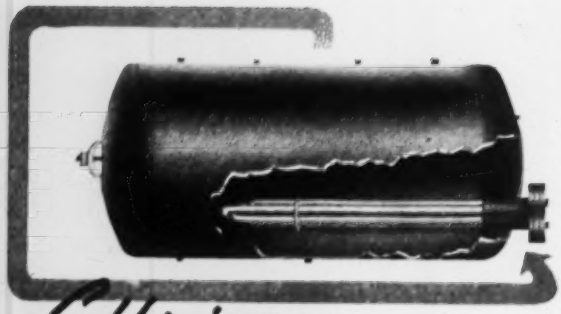

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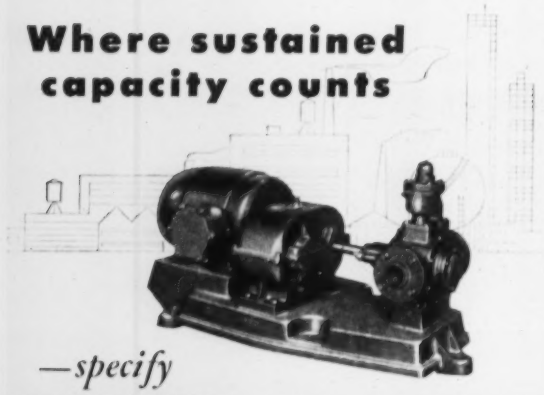

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World Symposium on Applied Solar Energy—Proceedings. 300 pp. John I. Yellott, secretary, Association for Applied Solar Energy, 204 Heard Building, Phoenix. $5.00.

Legal Problems in Engineering—By Melvin Nord. 391 pp. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. $7.50.

Method of Determining Concentration of Odorous Vapors (Tentative) D 1354 — 55T.; Methods for Continuous Analysis and Automatic Recording of the Sulfur Dioxide Content of the Atmosphere (Tentative), D 1355 — 55T.; Definitions of Terms Relating to Atmospheric Sampling and Analysis (Tentative), D 1356 — 55T.; and Recommended Practice for Planning the Sampling of the Atmosphere for Analysis (Tentative), D 1357 — 55T. Items are in Part 7 of 1955 Book of ASTM Standards and are available as separate pamphlets. American Society for Testing Materials, 1916 Race St., Philadelphia. 30c each.

Trane Refrigeration Manual—133 pp. The Trane Company, La Crosse, Wisconsin, $1.50.

Bibliography of Solid Adsorbents, 1943-1953, National Bureau of Standards Circular 566—By Victor R. Deitz. 1528 pp. U. S. Government Printing Office, Washington 25, D. C. $8.75.

Forced Circulation Air-Cooling Coils—ARI Standard 410-56. ARI headquarters, 1346 Connecticut Ave., N. W., Washington 6, D. C. 25c.

How To Negotiate a Successful Contract—By Louis M. Brown. 286 pp. Prentice-Hall, Inc., 70 Fifth Ave., New York 11. $5.65.

Pipelines to The Future, A Study of Plastic Pipe—64 pp. Monsanto Chemical Company, Plastics Division, Dept. HPAC, Springfield 2, Mass. $1.00.

Standard for Methods of Testing and Rating Forced-Circulation Air-Cooling and Air-Heating Coils—ARI Standard 411. ARI headquarters, 1346 Connecticut Ave., N. W., Washington 6, D. C. $1.00.

Sampling Procedures and Measuring Equipment, supplement (Manual Sheet P-72) to Chapter 6 of the Air Pollution Abatement Manual. 32 pp. Manufacturing Chemists' Association, Inc., 1625 Eye Street, N. W., Washington 6, D. C. Entire manual, $6.00, supplement, 75c. ≠

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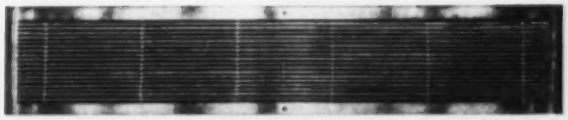

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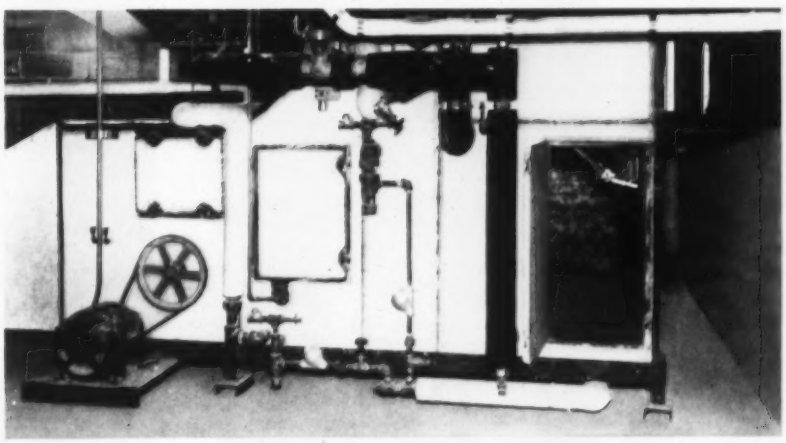

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It happened on a cold night in Chicago. The boiler operator had opened the hand fill valve when he noticed the boiler water was low, then went about other duties and forgot to close it. By next morning the whole system was flooded, the boiler room several feet deep. All business activity stopped; fifty employees were idle; the dealer doesn't like to think of how many service customers were inconvenienced.

There had been a low water cut-off on the boiler — a McDonnell No. 67. Its task was to interrupt the *electrical* circuit to burner in the event of low water. The *mechanical* task of adding water automatically to keep the boiler operating safely — and only as much water as needed, without forgetting — was a job that only a boiler feeder could do. Today there is a McDonnell No. 51 on that boiler as well as the original No. 67 Cut-off.

While this may sound like an unusual story, there are countless others to support the wisdom of providing both mechanical and electrical safeguards on every automatically fired boiler. A sticking fuel valve, or the residual heat in stoker installations,—for more examples,—may throw the burden of protection onto the feeder even though the cut-off has functioned as it should.

The best course, for you and your customer, is to recommend a McDonnell Feeder and Cut-off in every case. And that goes for hot water boilers as well as steam boilers.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

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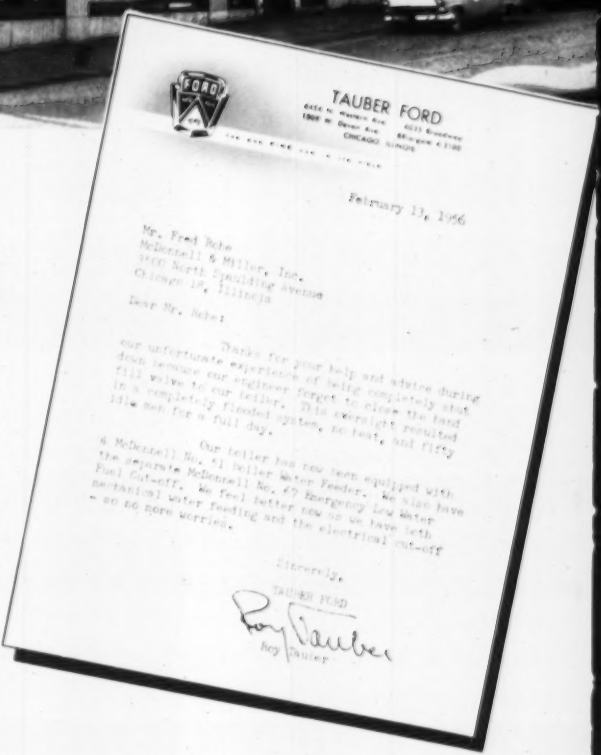


TAUBER FORD

February 13, 1956

Mr. Fred Bohr
McDonnell & Miller, Inc.
3500 North Spaulding Avenue
Chicago 18, Illinois

Dear Mr. Bohr:

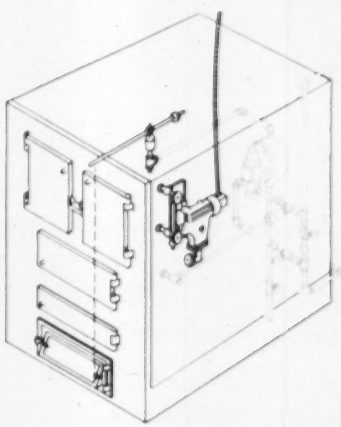
Thanks for your help and advice during our unfortunate experience of being completely shut down because our engineer forgot to close the hand fill valve to our boiler. This overnight neglect resulted in a completely flooded system, to heat, and fifty idle men for a full day.

Our boiler has now been equipped with a McDonnell No. 51 Boiler Water Feeder. We also have the separate McDonnell No. 67 Emergency Low Water Fuel Cut-off. We feel better now that we have both mechanical water feeding and the electrical cut-off - so no more worries.

Sincerely,

TAUBER FORD

Roy Tauber



There was a McDonnell No. 67 Cut-off on the boiler—an *electrical* safeguard. Now, to add a *mechanical* safeguard, there is also a never-forgetting McDonnell No. 51 Feeder (in red).

McDonnell No. 51 Feeder, for boilers up to 35 lbs. Separate feeders and cut-offs are recommended for large heating boilers and process boilers where greater variation in operating levels is needed.

McDonnell No. 67 Cut-off, for all steam boilers up to 20 lbs. For hot water heating boilers use No. 63 Cut-off, for pressures up to 50 lbs.

McDonnell No. 47-2 Feeder and Cut-off Combination, suitable for most heating boilers up to 30 lbs. Other McDonnell Feeders and Combinations for larger boilers, higher pressures.

McDONNELL *Boiler Water Level Controls*